RECORDS

OF THE

AUSTRALIAN MUSEUM

EDITED BY THE DIRECTOR

Vol. XX

PRINTED BY ORDER OF THE TRUSTEES

CHARLES ANDERSON, M.A., D.Sc., C.M.Z.S.
DIRECTOR

SYDNEY, 1937-40

NATIONAL MUSEUM
10 JULY 1941
VICTORIA

CORRIGENDUM.

Page 99, line 16. For *Favosties* read *Favosites.*

Page 302, line 18. For *Coptopterus decvoratus,* sp. nov. read *Coptopterus decoratus,* sp. nov.

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20 APR.

A NEW SPECIES OF SCINK FROM THE SOLOMON ISLANDS.

By

J. R. Kinghorn, C.M.Z.S.,
Herpetologist, The Australian Museum.

(Plate i.)

Until recently there were only two known species of the genus *Tribolonotus*, a peculiar genus thought to be restricted to New Guinea, but two more were found in the Solomon Islands by members of the Whitney South Sea Expedition and described by C. E. Burt during the year 1930. The following description is of a fifth species, also from the Solomon Group, and I have named it for the Rev. Father J. B. Poncelet, who has collected many excellent specimens of many kinds for the Trustees of the Australian Museum. Owing to the general shape of the body and the rows of large spines or scutes on the dorsal surface of this lizard, it has been referred to by laymen as a young crocodile. The native name, supplied by Fr. Poncelet, is *'Ubaibo'*.

NATIONAL MUSEUM OF VICTORIA

Tribolonotus ponceleti, sp. nov.

Definition.—Head strongly differentiated from the neck, with a slightly curved posterior border, which bears a number of short spines much smaller than those on the dorsal surface of the body. Eyelids well developed, scaly. Tympanum superficial, vertical, oval, and as large as the eye opening. Shields of head strongly rugose, the sutures thereby being very indefinite. Four supraoculars; a large preocular which forms a suture with the nasal; a large single shield covers the snout between the preoculars, the frontal, and the rostral. The parietals are somewhat broken up and not easy to define, though the posterior are the largest. Two large supra-temporals. The second labial is very small and does not completely separate the first from the third. The latter is exceptionally long and enters the orbital ring. Five lower labials, the first the longest. A large, azygous post-mental is followed by two pairs of chin shields. Dorsal surface of body covered with strongly keeled, spinose scales. The dorsal ridge is well developed and formed of a double row of strong curved spines, there being about twenty-nine of these between the head and the sacral region. Gular and ventral scales imbricate and keeled. There are four anal scales, the central pair considerably enlarged. Caudal scales spinose above and keeled ventrally, and there are forty-eight from the junction of the body to the tip of the tail. The hindlimb stretched forward does not reach to the axilla. The forelimb is covered above with strongly keeled, almost spinose scales. Digits well developed, roundish, with smooth transverse lamellæ under the fingers, and somewhat tubercular ones under the toes; there are twenty-five under the fourth toe.

Total length: 223 mm. (tip of tail missing); body, 110 mm. Head, 34 mm.; width of head, 25 mm.; width of neck, 12 mm. Hindlimb, 50 mm.

Colour (spirit specimen).—Dark brown above, with indications of lighter blotches or cross markings, more particularly on the tail. The hinder portion of the top and sides of the head are distinctly light brown. The lower surfaces are immaculate.

Distribution.—At present known only from the type locality, which is Buin, east Bougainville Island, Solomon Islands.

Described from a single specimen, the holotype (Number R.11459) in the Australian Museum.

Affinities.—Four other species of this remarkable genus are known: *T. novæ-guineæ* Schlegel[1] and *T. gracilis* de Rooij,[2] both from New Guinea, and *T. blanchardi* Burt[3] and *T. schmidti* Burt,[4] the former from Choiseul and the latter from Beagle, both localities in the Solomon Islands.

The following table gives the main differences between the four species:

	novæ-guineæ.	*gracilis.*	*blanchardi*	*schmidti.*	*ponceleti.*
Caudal spines	Upright double row. —	Project backwards, double row. —	Single row. 32	Double row. 29	Double row, backwards. 29
1st chin shield ..	As long as post-mental.	Longer than post-mental.	?	?	Shorter than post-mental.
Scale rows chin to vent	?	?	43	35	51
Lamellæ 4th toe ..	?	?	22	20	25

EXPLANATION OF PLATE I.

Tribolonotus ponceleti, sp. nov.

Fig. 1.—Ventral view to show chin shields, anal scales and keels of ventral scales. × 2/3, approx.

Fig. 2.—Dorsal view. × 2/3, approx.

Fig. 3.—Profile. × 4/3.

Fig. 4.—Top of head. × 4/3.

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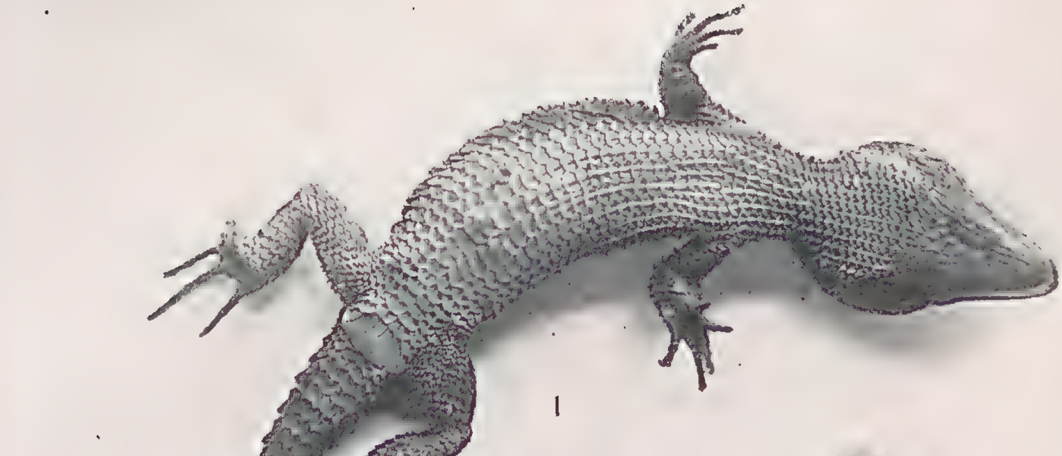
[1] de Rooij.—Rept. Indo-Austr. Arch., Vol. i, 1915, p. 281.
[2] de Rooij.—*Loc. cit.*, p. 281.
[3] Burt.—Amer. Mus. Novit., 427, 1930, p. 2.
[4] Burt.—*Loc. cit.*, p. 3.



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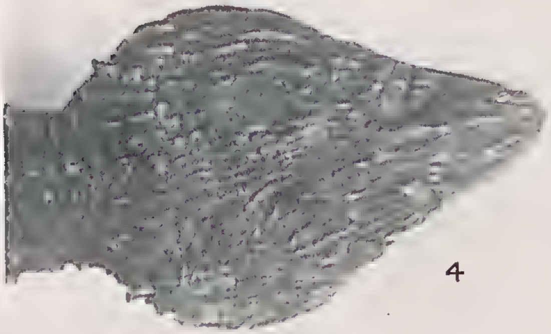

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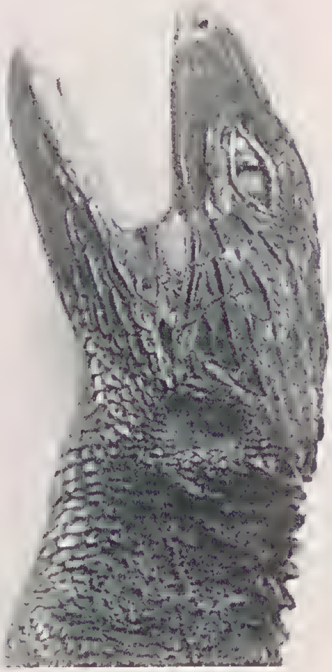

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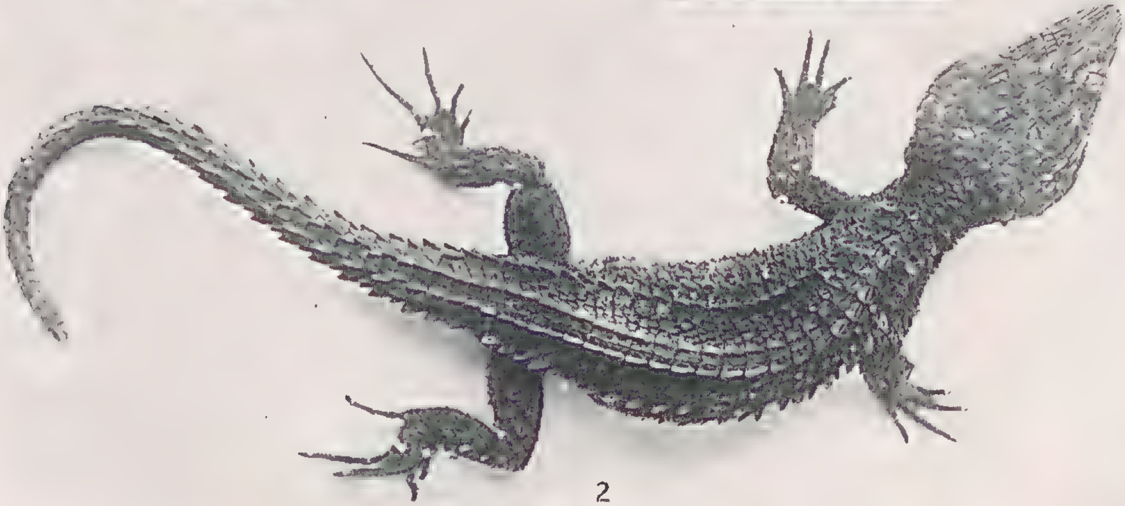

2

G. C. CLUTTON, photo.

NATIONAL MUSEUM OF VICTORIA

STUDIES IN ICHTHYOLOGY.

No. 10.*

By

GILBERT P. WHITLEY,
Ichthyologist, The Australian Museum.

(Plate ii, and Figures 1–5.)

Family CARCHARIIDÆ.

Genus **Carcharias** Rafinesque, 1810.

Carcharias arenarius Ogilby.

(Figure 1.)

Odontaspis cinerea Ramsay, Proc. Linn. Soc. N. S. Wales, v, 1, Aug., 1880, p. 96, footnote. *Nomen nudum ex* Macleay, MS.

Carcharias arenarius Ogilby, Ann. Qld. Mus. x, Nov. 1, 1911, p. 37. Moreton Bay, Queensland.

This species is the true Grey Nurse Shark of Australia, which has not hitherto been figured from a fresh specimen. Whilst on holidays at Bateman's Bay, New South Wales, in March, 1936, I saw a number of specimens caught by Mr. Zane Grey and his associates and also by local fishermen. The largest was about 9 ft. 9 in. over all, and was dirty pale brownish in colour; the smallest specimen was pale grey, with irregular light rusty spots. A specimen utilized by Mr. Grey in his cinema film was selected for drawing, and had the following characters:

Female. Total length, 9 ft. 4½ in. Depth about 18 in. Head, measured to first gill-slit, 22. Preocular length, 7½. Eye, 1. Snout, from upper lip, 5. Nostrils, 1½. Internarial space nearly 3½. Width of head just behind nostrils, 6. Symphysis of upper jaw to side of head, 3½. Length of one side of mouth, 7. Distance between outer labial folds, 10. Gill-slits about 7 in. wide, the last about 6, situated in advance of pectoral fin. No nictitating membrane or spiracles. Nine or ten functional teeth visible in front row of each side of both jaws in fresh specimen.[1] No median tooth. Labial folds rather ovally rounded. Median part of lower lip produced forward anteriorly. Body robust, the margins of the fins rounded. Predorsal length, 45 in. Base of first dorsal, 9. Interdorsal space, 15. Base of second dorsal, 7½. End of second dorsal to caudal, 7. Anal origin to base of caudal, 10. The origin of the anal fin is below the posterior part of the second dorsal fin. Ventral origin to anal origin, 15. Base of ventral fin, 9. Pectoral origin to ventral origin, 30½; to tip of snout, 29. Length of pectoral, 16; its base, 6½. Height of anal fin, 8. Upper caudal lobe, 28; lower caudal lobe, 11. Caudal peduncle, 3½ in. between end of anal and origin of lower caudal lobe, or 7 from end of second dorsal. No caudal keel, but a slight pit above. Depth of caudal peduncle, 5.

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* For No. 9, see RECORDS OF THE AUSTRALIAN MUSEUM, Vol. xix, No. 4, September, 1935, p. 215.

[1] Cleaned jaws at Mr. Zane Grey's camp had the following formula:

Upper jaw—

14 very small, 8 $\left\{\begin{matrix}\text{increasing}\\ \text{in size}\end{matrix}\right\}$ (gap), 1 small, 3 large $\left\{\begin{matrix}\text{none at}\\ \text{symphysis}\end{matrix}\right\}$, 3, 1 (gap), 8, 11.

Lower jaw—

10 very small, 9 $\left\{\begin{matrix}\text{increasing}\\ \text{in size}\end{matrix}\right\}$, 1 smaller $\left\{\begin{matrix}\text{none at}\\ \text{symphysis}\end{matrix}\right\}$, 1, 9, 10.

General colour light greyish-brown, white below. Eye pale dirty yellow to white, with very small black pupil.

Described and figured from a female specimen caught off Bateman's Bay, New South Wales, by Mr. Zane Grey, March 17, 1936.

It may be of interest to record that a smaller specimen of the present species, measuring 8 ft 11 inches at death, was kept in captivity for two years in the Aquarium at Taronga Zoological Park, Sydney. It has been replaced by two other examples, still living there, and sketches of one of these, with its attendant Pilot Fish, are included here.

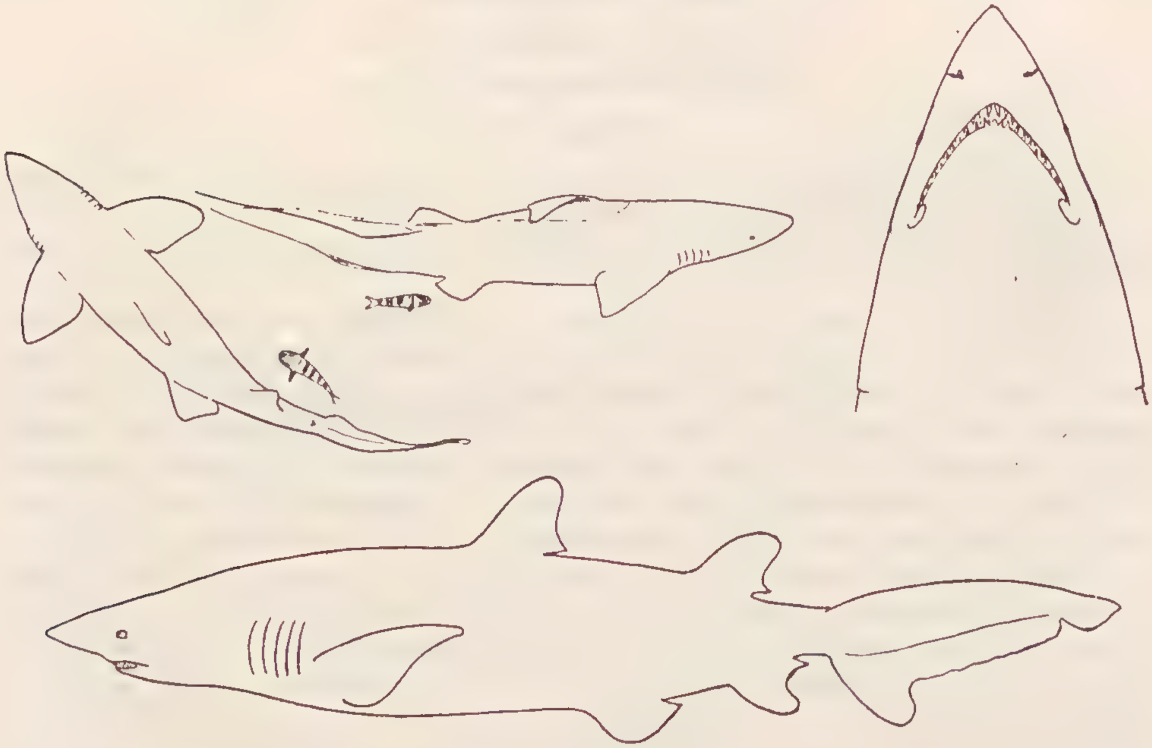

Fig. 1.—*Carcharias arenarius* Ogilby. A female specimen, 9 ft. 4½ in. long, from Bateman's Bay, New South Wales. Also (above) two sketches of a living Sydney specimen, 9 ft. long, accompanied by Pilot Fish, in Taronga Park Aquarium.

G. P. Whitley, *del.*

Family SPHYRNIDÆ.

Genus **Sphyrna** Rafinesque, 1810.

Sphyrna lewini (Griffith).

Zygæna lewini Griffith, Anim. Kingdom (Cuvier), x, 1834, p. 640, pl. 1. "Off the south coast of New Holland" = Sydney, N. S. Wales.

Sphyrna lewini Whitley, Mem. Qld. Mus., x, 4, June 30, 1934, p. 192, pl. xxviii (refs. and syn.—Moreton Bay, Queensland, specimen figured).

Several Hammerhead Sharks were caught at Bateman's Bay by Mr. Zane Grey and others, though none was as large as the record sized Australian specimen weighing 565 lb., which was caught earlier in 1936 at Bermagui. Some measurements of a Bateman's Bay specimen were as follows:

Length, 9 ft. 10½ in. Width of head, 34 inches. Depth of hammer, 8 or nearly 6½ near the eye, which is 1½ in. in diameter. Gill-slits 3 to 4 in., the last two over the pectoral; the first is the longest, and is 6 in. from the last. Head, measured to last gill-slit, 2 ft. Depth of body, 18 in. Depth at middle of base of ventrals, 12½. Pectoral fin, 17½; its base, 7½. Pectoral origin to ventral region, 36. Ventral, 5; its base, 5½. End of ventral base to origin of anal, 10. Anal base, 4½; its height, 6¼, and produced end, 5. End of anal base to lower caudal pit, 8½. Upper caudal pit further back than lower. Lower lobe of caudal fin, 15. Depth of caudal fin at its middle, 7. Upper lobe of tail, from caudal pit, 30½. Subcaudal lobe, 6. Depth of caudal peduncle, 4½. Base of tail to end of second dorsal base, 9. Base and height of second of second dorsal fin about 3½; produced end nearly 6. Second dorsal fin smaller than anal, originating over half the anal base and ending slightly behind end of anal base. Depth between the two fins nearly 8 in. Back rounded; form robust. Interdorsal space, 35 in. Base of first dorsal fin, 11¾; its height, 16, and posterior ray, 4. The origin of the first dorsal fin is about on a level with the posterior axil of the pectoral.

Colour ashy grey above, fading to pale yellowish below. Eye dull bluish. Orbit and part of nictitating membrane brown. Female.

This Bateman's Bay example had a rather longer caudal lobe, plumper body, and nostril grooves longer than those of the Moreton Bay specimen figured in 1934, but that was a younger female, and the two are obviously conspecific. The teeth become finely denticulated as the Hammerhead Shark grows older.

Family ALOPIIDÆ.

Genus Alopias Rafinesque, 1810.

Alopias greyi, sp. nov.

Thresher Sharks are usually identified from all parts of the world as *Alopias vulpinus* (Bonnaterre) or *vulpes* (Gmelin), but modern authors, by studying specimens more closely, have proved that several distinct species (if not genera) exist, and sometimes, as has been demonstrated in Formosa by Nakamura,[2] more than one species may occur in a restricted region. Phillipps[3] has recently separated the typical Australian Thresher Shark from *vulpinus*, naming it *Alopias caudatus*; but still another species has been shown to occur in our seas by Mr. Zane Grey,[4] who caught a specimen weighing about 314 lb. off Bermagui, New South Wales, on February 9, 1936. Mr. Grey has caught many examples of the true *A. vulpinus*, which he is therefore in a position to distinguish, and I agree with him that his Bermagui specimen apparently represents a new species, which I now name in his honour. The outstanding difference of *A. greyi* is its greenish instead of slaty coloration, and the eyes, which are modified for backward vision, are situated much further forward than in *A. vulpinus*. The total length was ten feet, of which the tail was said to be about half. Caudal peduncle thick, and dorsal and ventral fins elevated. Photographs of the specimen appeared in the Sydney newspapers of February 12 to 14, but only the jaws were preserved, and these, I understand, are destined for the American Museum of Natural History, New York.

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[2] Nakamura.—Mem. Fac. Sci. Taihoku Imp. Univ. (Formosa), xiv, 1, 1935, p. 2, pls. i-iii.

[3] Phillipps.—N. Zeal. Journ. Sci. Tech., xiii, 4, Feb., 1932, p. 226, fig. 1 (Victoria and New Zealand).

[4] Grey.—Angling and Gun Sport (Sydney), i, 11, June, 1936, p. 9, and fig.

Family ALBULIDÆ.

Genus Albula Scopoli, 1777.

Albula Scopoli, Intr. Hist. Nat., 1777, p. 450. *Ex* Gronow, Zoophyl, i, 1763, p. 102, non-binomial. Haplotype, *Esox vulpes* Linné.

Butyrinus Lacépède, Hist. Nat. Poiss., v, 1803, p. 45. Haplotype, *B. bananus* Lacépède = *Esox vulpes* Linné. Also spelt *Butirinus* by Rüppell, 1837, and *Buturinus* by Cuvier and Valenciennes, 1846.

Glossodus Agassiz, Piscium Brasil (Spix), 1828, p. 48. Type, *Glossodus forskali* Agassiz = *Esox vulpes* Linné. Not seen.

Esunculus Kaup, Cat. Apodal Fish. Brit. Mus., 1856, p. 143. Haplotype, *E. costai* Kaup, supposed to be Mediterranean. Larval form.

Conorhynchus Gill, Cat. Fish E. Coast N. Amer. (Proc. Acad. Nat. Sci. Philad., 1861, supplement), 1861, p. 55. *Ex* Nozemann, 1757, pre-Linnean. Haplotype, *Butyrinus vulpes* Storer. Name preoccupied by *Conorhynchos* Bleeker, 1858, a genus of catfishes, and *Conorhynchus* Motschoulsky, 1860, a genus of Coleoptera.

Atopichthys Garman, Mem. Mus. Comp. Zool. Harvard, xxiv, 1899, p. 326. Logotype, *A. esunculus* Garman, selected in Jordan's Genera of Fishes, iv, 1920, p. 486. Larval form.

In my opinion, *Esunculus costai* Kaup, which was supposed to have come from the Mediterranean, but might well have come from elsewhere, is a larval *Albula*, and Kaup's generic name may be added to the synonymy of this genus. Regarded as a leptocephalus larva by its author, *Esunculus* was thought by Günther to be more like an Alepocephalid, and later authors have slavishly followed him.

Another genus, *Atopichthys*, was proposed by Garman for larval eels in general, but his first species, *A. esunculus*, with forked tail and having ventral fins (no eel has these), was selected as logotype. Garman's larva is obviously a larval *Albula* and not an Alepocephalid, as Jordan, Evermann, and Clark suggested in the latest North American Check-List.

Apart from Kaup and Garman, Gill,[5] and Delsman and Hardenberg[6] have given good figures of the *Esunculus* larva of *Albula*, and now Miss Hollister[7] adds an account of its metamorphosis in her paper on "A Fish which Grows by Shrinking".

Albula vulpes Linné?

(Figure 2.)

A series of five larval fishes was labelled *Atopichthys* sp. in the Australian Museum collection, and stored with the leptocephalid larvæ of eels. The forked tails and small ventral fins showed, however, that they were not Apodes, and they are now identified as the *Esunculus* larvæ of *Albula*. The characters are rather difficult to make out, but the specimens are from 53 to 58 mm. in standard length, or up to about 2½ inches over all. They appear to have 64 myomeres, excluding the hypural region, and more than 20 caudal rays, but the other fin formulæ are doubtful.

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[5] Gill.—Smithson, Misc. Coll., xlviii, 1, 1905, p. 43, fig. 7.

[6] Delsman and Hardenberg.—Indische Zeevisschen., 1934, p. 118, fig. 74.

[7] Hollister.—Bull. N.Y. Zool. Soc., xxxix, 3, 1936, p. 104, and figs. And Zoologica, xxi, 1936, p. 268, figs. 21-39.

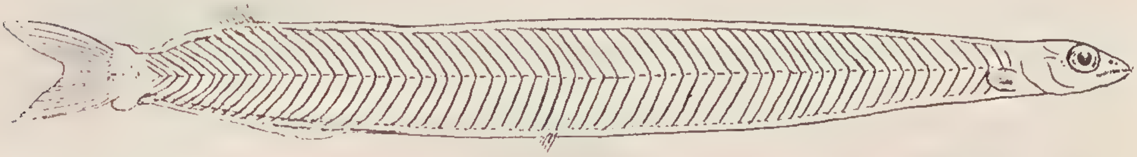

Fig. 2.—*Albula vulpes* Linné? A larval specimen, in the *Esunculus* or *Atopichthys* stage, 58 mm. long, from the New Hebrides.
G. P. Whitley, *del.*

The largest specimen is here figured. It has the head (5·5 mm.), about one-tenth, and the depth (7), which may have shrunk, about one-eighth of the standard length (58). The eye (2) is longer than the snout (1·6). Head, small, conic; the brain visible through the dorsal surface. Nostrils large. Mouth reaching to below eye and armed with a single series of anteriorly sloping teeth. There are a few, very fine, forwardly projecting teeth at the symphyses, but I cannot distinguish any on the palate. Tongue rounded. A few mucus pores on the head behind eyes.

Myomeres angular, with a dimple on each over the course of the vertebral column. Dorsal fin originating over 50th myotome, ventrals on the 32nd, and anus below 61st, the anal fin being rudimentary and situated under the last myomeres. Ventral fins originating about halfway between pectoral and root of tail. Caudal strongly forked.

Colour in spirit, pale brownish; eyes blue. A row of punctulations along course of alimentary canal and a few dots at root of tail.

Locality.—New Hebrides; collected by Dr. A. D. C. Cummins and Paymaster P. B. Stevens, R.N., of H.M.S. "Pegasus", many years ago. Austr. Mus. Regd. No. I.13794.

The number of myotomes varies little except that it may later be reduced with age.

A comparison of my figure with several others shows surprising similarity, demonstrated by the following table:

Specimen.	Myotomes.	Dorsal Origin over Myotome.	Ventral Fin or Air-Bladder at Myotome.	Anal Origin under Myotome.	Locality.	Authority.
Esunculus costai	69	54	33	63	Mediterranean ?	Kaup.
Atopichthys esunculus ..	70	54	32	70	Mexico.	Garman.
Albula vulpes	71	55	32	69 ?	California.	Gill.
,, ,, ...	71	54	35	67	,,	Delsman and Hardenberg.
Albula sp.	64	50	32	62	New Hebrides.	Whitley.

Family LEPTOCEPHALIDÆ.

Genus Poutawa Griffin, 1936.

Poutawa Griffin, Trans. Roy. Soc. N. Zeal., lxvi, 1936, p. 16. Haplotype, *Congrus habenatus* Richardson.

The late L. T. Griffin, of Auckland, proposed the above name for the Little Conger Eels of New Zealand and Australia, with *Congrus habenatus* Richardson as orthotype. The Australian form was named *Congromurœna longicauda* by Ramsay and Ogilby, but neither Mr. Griffin nor the present writer could discover unvarying characters which would separate the two specifically. A *Leptocephalus* larva recently collected near Sydney is apparently referable to *Poutawa habenata longicauda.*

Poutawa habenata longicauda (Ramsay and Ogilby).

(Figure 3.)

Congrus habenatus Richardson, Zool. Voy. Erebus and Terror, Fish, 1848, p. 109, pl. l, figs. 1–5. Cook Strait, New Zealand.

Congromurœna longicauda Ramsay and Ogilby, Proc. Linn. Soc. N. S. Wales (2), ii, March 21, 1884, p. 1022. Parramatta River, N. S. Wales. *Id.* Whitley, Abstr. Proc. Linn. Soc. N. S. Wales, 488, May 29, 1936, p. 2 (larva).

Poutawa habenata Griffin, Trans. Roy. Soc. N. Zeal., lxvi, 1936, p. 16, pl. vii, fig. 2; text-figs. 3–4.

On Sunday, May 24, 1936, I was fortunate enough to see, on Maroubra beach, Sydney, the *Leptocephalus* larva of an eel, its anterior end buried in the sand, where it had doubtless been washed up by the very heavy south-easterly seas at that time. There have been but few records of larval eels in Australasian waters, and, in view of the importance attached to researches on these animals in other parts of the world, the present specimen seems worthy of notice. Gill[8] was apparently the first zoologist to realize the true nature of leptocephali, stating: "I am almost certain that the typical *Leptocephali*, at least, are the young of *Congers*, and that *Leptocephalus morrisii* is the young of *Conger vulgaris*."

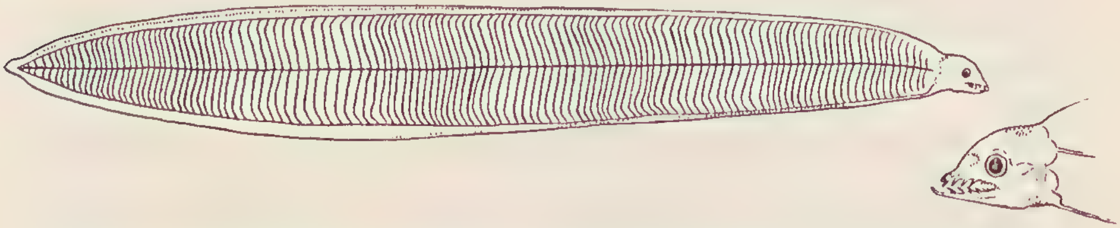

Fig. 3.—*Poutawa habenata longicauda* (Ramsay and Ogilby). A larval specimen, in the *Leptocephalus* stage, 70 mm. long, from Maroubra beach, near Sydney, New South Wales.

G. P. Whitley, *del.*

The Maroubra specimen is elongate and strongly compressed, the body being transparent, smooth to the touch, and of somewhat gelatinous consistency.

The greatest depth (9·5 mm.), which occurs in the posterior half of the body, goes 7·3 times in the total length (70). The head is small, not quite 4 mm. long, and is deflected downwards. There is a neck-like constriction, nearly 3 mm. deep, before the leaf-shaped body.

Top of head dome-shaped, the muzzle pointed. A single series of long, thin, forwardly-directed teeth in each jaw, the foremost in the lower jaw being particularly prominent. The upper jaw is curved and the mouth extends to below eye. The nostrils cannot be satisfactorily distinguished. Eye large, non-telescopic, its vertical diameter greater than its horizontal and partly surrounded by rudimentary canals. The brain and gullet form opaque masses near the incipient gills, delimiting the head from the transparent body. The alimentary canal reaches backwards almost to half the length of the specimen; it is fairly straight and not festooned.

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[8] Gill.—Proc. Acad. Nat. Sci. Philad., 1864, p. 207.

The backbone runs along the median line. There are 127 myomeres; the myocommas are not particularly angular. Posteriorly, the dorsal and anal fins are fairly high. Their origins are difficult to trace, but minute dots, suggesting incipient finrays, commence on the dorsal fin above the 45th myomere, but on the anal fin they extend forward to below the 13th myomere.

The dorsal, caudal, and anal fins are confluent, but there is a notch above and below the margin of the caudal. There appear to be no pectoral fins and, of course, no ventrals.

Colour in life, transparent milky-white, the head slightly more opaque; the eye blue with a silvery ring. In spirit the specimen became rather more opaque and minute black dots could be distinguished, under the microscope, on the jaws, gill-region, occiput, edges of dorsal and anal fins, and along the most posterior part of the backbone. No large spots on body.

Described and figured from a larva, 70 mm. long, from Maroubra, near Sydney, N. S. Wales. Australian Museum Reg. No. IA.6893.

My reason for regarding the Maroubra *Leptocephalus* as the larva of the Little Conger, *Poutawa habenata longicauda*, is that it agrees in myotome formula with a 90 mm. specimen of that species from off Cape Everard, Victoria, which has practically metamorphosed (Austr. Mus. Regd. No. IA.6263). Moreover, in general details, my specimen, when tested by keys to European species, always enters the sections relating to larvæ of the *Congermurœna* group, though it does not agree with any of the available illustrations published by Kaup, Bleeker, Schmidt, Weber, d'Ancona, Fowler, Deraniyagala, Bertin, and others.

Records of Australasian Leptocephali.

The first record of a glass eel or *Leptocephalus* larva in Australasian seas appears to be that of Dr. George Bennett, who, in his "Gatherings of a Naturalist in Australasia", London, 1860, p. 56, fig. 6, figured a long-snouted Atlantic form and noted others, adding: "Many different species, and probably genera, were also taken in the Australian seas." Günther[9] merely notes, under *Leptocephalus morrisii*, the locality: "Australia. From the Haslar Collection."

Dr. Julius Haast[10] read a paper "On the Occurrence of *Leptocephalus longirostris*, Kaup, on the Coast of New Zealand", recording:

"A specimen presented by Mr. John Grigg, of Long Beach station, to the Canterbury Museum, which was picked up on the Ninety-mile beach during the strong north-east storm towards the latter part of the month of August [1874]."

Another Neozelanic larva, identified as *Leptocephalus altus* Richardson, was briefly recorded by Hutton:[11]

"Several specimens of this curious fish have been picked up on the Ocean beach at Dunedin."

The original *Leptocephalus altus* was described by Richardson[12] from a drawing made by Dr. Hooker, who failed to indicate the exact locality of the specimen, which may, therefore, not have been Australasian in origin.

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[9] Günther.—Cat. Fish. Brit. Mus., viii, 1870, p. 139.
[10] Haast.—Trans. N.Z. Inst., vii, 1875, p. 238.
[11] Hutton.—Trans. N.Z. Inst., viii, 1876, p. 215.
[12] Richardson.—Zool. Voy. Erebus and Terror, Fish., 1845, p. 51, pl. xxx, figs. 8-10.

Macleay, in his Descriptive Catalogue of Australian Fishes, merely copied Günther's record of *Leptocephalus morrisii.*

In 1894, leptocephali were found near Sydney—at Maroubra, in March, and Dee Why, in May—and were recorded without detailed description by Waite.[13] A little later, Ogilby[14] gave the first description and figure of the local species in his paper "On a Larval Teleost from New South Wales". He had three specimens, one from La Perouse and two from Maroubra, which he regarded as quite distinct from the European *Leptocephalus morrisii*, as they had no caudal fins and had 148 to 150 myomeres. In check-lists these eel larvæ were entered as *Atopichthys* sp., employing the generic name proposed for all larval eels by Garman.[15] However, Garman's name cannot be used, since the logotype of his genus *Atopichthys* is not an eel but a larval *Albula*, and it would be better to use the name *Leptocephalus* for glass eels whose adults are not known. Apart from *Leptocephalus* and its synonyms, many eel larvæ have been generically named.

Anderton[16] wrote: "I have taken *Leptocephali* in the winter months on the beaches near Dunedin, but do not know of what species it was the larval form."

McCulloch's 1929 Check-List included the known Australian records under *Atopichthys altus* (Richardson).

When the "Dana" Expedition was here in 1928, numbers of leptocephali were caught in the Tasman Sea. With the exception of the "duck-billed" *Nessorhamphus ingolfianus* (Schmidt),[17] these specimens do not appear to have been worked out, but I understand that *Anguilla* was not represented amongst them.

Bruun (Dana Rept., ix, 1937, p. 13, pl. i) has just described a new *Leptocephalus* larva, from east of New Zealand, as *Synaphobranchus danæ.*

The Australian Museum has several specimens of leptocephali, obviously pertaining to various genera and species, from New South Wales, Lord Howe Island, and even Queensland, from which State no *Leptocephalus* has hitherto been recorded. The Queensland larva was collected at McCulloch Reef, near Cairns, by the late W. E. J. Paradice, who made the following field note:

"At night, during the first week of October, 1923, among the outer reefs [between 17° and 18° S. Lat.—G.P.W.], large numbers of glass eels two or three inches long appeared on the surface and long toms [*Strongylura*] were often found devouring them."

Unfortunately, only one specimen was preserved. It is quite different from all my N. S. Wales larvæ, and appears to belong to some other family of eels. Austr. Mus. Regd. No. IA.2363. Length, 79 mm.; *circa*, 112 myomeres.

For the sake of completeness, I may mention, in this *résumé* of Australasian records, that Waite[18] listed a glass eel, 9·5 mm. long, from off Drygalski Island, Antarctica, in 20 fathoms; 21 January, 1914, and also[19] noted from the Kermadec Islands several small leptocephali regarded as *Congrellus*, and a number of larvæ of different genera of eels.

Leptocephali have also been recorded from New Guinea and various parts of the Pacific Ocean.

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[13] Waite.—Proc. Linn. Soc. N.S. Wales (2), ix, 1894, p. 225.

[14] Ogilby.—Proc. Linn. Soc. N.S. Wales, xxii, 1897, p. 158, and fig.

[15] Garman.—Mem. Mus. Comp. Zool. Harvard, xxiv, 1899, p. 326.

[16] Anderton, Bull. N.Z. Board Sci. Art, ii, 1921, p. 71.

[17] *Leptocephalus ingolfianus* Schmidt, Vidensk. Medd. Dansk. nat. Foren., lxiv, 1912, p. 49, pl. iii, fig. 8 (Sargasso Sea and Azores) = *Nessorhamphus ingolfianus* Schmidt, Vidensk. Medd. Dansk. nat. Foren., xc, Dec. 22, 1930, p. 373, pls. iv-v, and Nature, cxxvii, March 21, 1931, p. 445, and fig.

[18] Waite.—Sci. Rept. Austr. Antarct. Exped (c), iii, Fishes, 1916, p. 13.

[19] Waite.—Trans. N.Z. Inst., xlii, 1910, p. 374.

Genus **Exonautes** Jordan and Evermann, 1896.

Exonautes Jordan and Evermann, Rept. U.S. Fish. Comm., 1895, Append. 5, Dec. 28, 1896, p. 322. Orthotype, *Exocœtus exsiliens* Muller = *Exocœthus exsiliens* Linné, Mantissa, ii, 1771, p. 529, from Carolina.

Procypsilurus Bruun, Dana Report, vi, 1935, p. 84. Orthotype, *Cypsilurus exsiliens* (Linné, 1771).

These two generic names, having the same type species, must be regarded as synonyms.

Exonautes katoptron (Bleeker).

Exocœtus katoptron Bleeker, Nat. Tydschr. Dierk., iii, 1865, p. 115. *Id.* Bleeker, Atl. Ichth., vi, 1871, p. 72, pl. ccxlvii, fig. 3. Sumatra.

? *Exocœtus robustus* Günther, Cat. Fish. Brit. Mus., vi, 1866, p. 289. Australia.

Cypsilurus katoptron Jordan and Seale, Bull. U.S. Bur. Fish., xxv, 1905 (1906), p. 211, fig. 16.

Cypsilurus katoptron McCulloch, Rec. W. Austr. Mus., i, 1912, p. 84.

McCulloch has noted a flying fish from Fremantle, W. Australia, which is said to differ from Jordan and Seale's figure in having a slightly larger eye, and 13 instead of 14 dorsal rays, thereby agreeing with *katoptron*. It differed from Günther's *robustus* in having the interorbital concave instead of flat, and in the more posterior situation of the ventrals. A similar specimen is described hereunder.

D.14, A.11, P.1+14, V.6, C.15. About 50 transverse rows of scales and about 30? predorsal scales. L. tr. ?.

Head (52 mm.) 24%, snout (12·5) 57·8%, eye (18) 8·3%, interorbital (16) 7·4%, pectoral (147) 68%, ventral (72) 33%, predorsal length (154) 71·3%, breadth of body (26) 12%, depth (34) 15·7%, height of dorsal (28) 13%, preventral length (126) 58·3%, preanal length (172) 79·6% of standard length (216). Total length about 11 inches, the caudal tips being broken.

A four-winged flying fish with the head pointed, the lower jaw being longer than the upper. Interorbital sunken. Jaws toothed. No palatine teeth. Anal origin behind that of dorsal. Pectorals not reaching root of tail. Ventrals reaching end of anal base, their first two rays short and thickened. Their origin is nearer the base of the tail than the nostril.

Colour after long preservation in spirit, brownish. Pectorals dark brown, with a broad median hyaline area. Ventrals with a large dark distal blotch. Dorsal and anal plain.

Described from a specimen about 11 inches in total length from near Perth, Western Australia; collected by A. Abjornsen in 1910. Austr. Mus. Regd. No. I.11343.

This is doubtless the species recorded from De Witts Land, Western Australia, as *Exocœtus spilopus* by Cuvier and and Valenciennes, and more closely agrees with *Exocœtus robustus* Günther, except for some proportions.

Family SUDIDÆ.

Genus **Paralepis** Bosc, 1818.

Paralepis Bosc, Nouv. Dict. Hist. Nat., Ed. 2, xxiv, Sept., 1818, p. 520. Latinization of "Les Paralepis" Cuvier, Règne Anim., Ed. 1, ii, "1817" = Dec., 1816, pp. xi and 289, vernac. Tautotype, "*le Coregone paralepis*" Cuvier, vernac. *ex* Risso

MS. = *Coregonus paralepis* Fleming, Philos. Zool., ii, 1822, p. 393, *ex* Risso MS. = *Paralepis coregonoides* Risso, 1820 (*fide* Sherborn). *Id.* Risso, Journ. de Physique, xci, Oct., 1820, p. 253; *fide* Sherborn, Index Anim. (2), 1929, p. 4749. *Id.* Schinz, Thierreich (Cuvier), ii, 1822, p. 467. *Id.* Risso, Hist. Nat. Europe Merid., iii, 1826, p. 472. *Id.* Cuvier and Valenciennes, Hist. Nat. Poiss., iii, 1829, p. 488, and of later authors.

This generic name was first introduced in vernacular form by Cuvier, but Bosc was evidently the first to latinize it, and he thus becomes the author of the genus. The genotype is *Paralepis coregonoides* Risso, as shown in the above synonymy.

Family LUTJANIDÆ.

Genus **Lutjanus** Bloch, 1790.

Lutjanus longmani, sp. nov.

D.xi/15; A.iii/9; L.lat. *circa* 45.

Head, measured from chin (4½ inches) 2·7, depth of body (nearly 5) 2·5 in standard length (12½). Eye less than the broadly convex interorbital, which is 4·5 in head. No fossa between eyes and nostrils. Anterior profile of head oblique, not strongly convex.

Lower jaw the longer. Maxillary smooth, without supplementary bone, but followed by a short slit behind the rictus. A single canine, rather larger than its fellow, on each side of upper jaw, forms part of a single series there, but most of the teeth are almost hidden by the coriaceous parts of the lips. A dozen or so small spaced canines in a single series on each side of the lower jaw. Vomerine and palatine teeth in patches shaped much as in *Lutjanus coatesi* Whitley,[20] except that the boomerang-shaped vomerine patch, which has no backward extension, is comparatively larger. Tongue smooth, ovally rounded.

Preoperculum with shallow notch, its margin finely denticulated above and serrated below the notch. No prominent interopercular boss. Opercles, excepting preopercular limb, scaly. Suborbital, preorbital, and rest of head, naked. Pseudobranchiæ present.

General characters as in *Lutjanus coatesi.*

Scale-rows following the curve of the back. Predorsal scales not extending over top of head.

Dorsal and anal lobes not produced. Caudal truncate.

Colour in life, fairly uniform rosy pinkish, entirely without spots or bars of any other colour. Eye vivid red, with a dense black pupil.

Locality.—Off Lindeman Island, North Queensland, August 5, 1935. Coll. G. P. Whitley. The species was commonly caught by line fishing. Described from the holotype, a specimen a little over a foot long. Austr. Mus. Regd. No. IA.6584.

The Red Emperor of the fishermen and Wirrainbaya of the Whitsunday Passage aborigines. Named in honour of Mr. H. A. Longman, Director of the Queensland Museum, in appreciation of his continual help in placing at the writer's disposal very many unique and rare fishes in the collections under his charge.

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[20] Whitley.—Mem. Qld. Mus., x, 1934, p. 177, fig. 1.

Family GIRELLIDÆ.

Genus **Girella** Gray, 1835.

Girella tricuspidata (Quoy and Gaimard).

Boops tricuspidatus Quoy and Gaimard, Voy. Uranie. Zool., 1824, p. 296. Shark Bay, Western Australia.

Doidyxodon australis Thominot, Bull. Soc. Philom. Paris (7), v, 1881, p. 142. *Ex* Guichenot MS. Australia (Verreaux).

Aplodon margaritiferum Thominot, Bull. Soc. Philom. Paris (7), vii, 1883, p. 142. *Ex* Aug. Dumeril MS. Port Phillip, Victoria (Müller).

Aplodon castelnaui Thominot, Bull. Soc. Philom. Paris (7), vii, 1883, p. 142. Australia (Castelnau).

Aptodon sulcatus Thominot, Bull. Soc. Philom. Paris (7), vii, 1883, p. 143. *Ex* Guichenot MS. Port Phillip, Victoria (Müller).

Girella tricuspidata McCulloch, Rec. Austr. Mus., xiii, 2, 1920, p. 60, pl. xiv, fig. 1, and Austr. Mus. Mem., v, 1929, p. 239.

My friend, Mr. Anthony Musgrave, entomologist of the Australian Museum, during a recent trip round the world, kindly arranged for typewritten or photostat copies to be made of some descriptions of Australasian fishes in rare books which were not available in Australia. Copies of papers by French authors in the Bullétin de la Société Philomatique de Paris were particularly helpful to me in determining the identity of some Girellid and Seriolid fishes. As one result, therefore, I am able to add four specific names proposed by Thominot to the synonymy of the Ludrick or Blackfish, *Girella tricuspidata*, as tabulated above. Further synonyms and an excellent figure were given by McCulloch (*loc. cit.*). South Australia was inadvertently omitted from the range of this species in the Australian Check-List (1929).

Family THUNNIDÆ.

Genus **Neothunnus** Kishinouye, 1923.

Neothunnus Kishinouye, Journ. Coll. Agri. Univ. Tokyo, viii, 3, March 30, 1923, pp. 433 and 445. Logotype, *Thynnus macropterus* Temminck and Schlegel, selected by Norman, Zool. Record, lx, 1923 (1924), Pisces, p. 33.

The Yellow-fin Tuna, which forms an important article of commerce in Japan and California, is now demonstrated to occur off the coast of New South Wales.

Neothunnus macropterus (Temminck and Schlegel).

(Plate ii, fig. 1.)

Thynnus macropterus Temminck and Schlegel, Fauna Japonica, Pisces, 1844, p. 98, pl. li. South-western Japan.

Pelamys macropterus Bleeker, Nat. Tijdschr. Dierk., ii, 1865, p. 285, and Versl. Akad. Amsterdam, xviii, 1879, p. 15.

Orcynus macropterus Kitahara, Journ. Fisher. Bur. vi, 1897, p. 2, pl. ii, fig. 3—*fide* Kishinouye, 1923.

Germo macropterus Jordan and Seale, Bull. U.S. Fish. Comm., xxv, 1905 (1906), p. 228. *Id.* Jordan and Jordan, Mem. Carneg. Mus., x, 1, 1922, p. 32.

Neothunnus macropterus Kishinouye, Journ. Coll. Agric. Univ. Tokyo, viii, 3, 1923, p. 446, figs. 13, 19, 23, 45 and 51. *Id.* D. S. Jordan, Natural History, xxv, 4, 1925, p. 344 and lowest fig. *Id.* E. K. Jordan, Proc. U.S. Nat. Mus., lxvi, 1925,

p. 13. *Id.* Jordan and Hubbs, Mem. Carneg. Mus., x, 2, 1925, p. 219. *Id.* Jordan and Evermann, Occas. Pap. Calif. Acad. Sci., xii, 1926, p. 20, pl. iii, fig. 3, and pl. v. *Id.* Corwin, Bull. Div. Fish and Game Calif., xxii, 1930, p. 89 (bibliography). *Id.* Ponsford, Wide World, Oct., 1932, p. 472. *Id.* Herre, Fish. Herre Exped., 1934, p. 6, and Zool. Ser. Field Mus. Nat. Hist., xxi, 1936, p. 106.

Mr. Emil Morhardt kindly presented me with the accompanying photograph of the only known Australian specimen of this species, which was caught about thirty miles off Bermagui, New South Wales, by Mr. Zane Grey on February 26, 1936. The fish, which was not preserved, weighed 91 lb., and its fins and finlets were bright yellow. Other examples of this Tuna were seen leaping from the water at the time. This gregarious and migratory species has been recorded from Japan, Hawaii, the Philippines, East Indies, parts of Oceania, Galapagos, California, etc. For references to literature, see Miss Corwin's "Bibliography of the Tunas" (*loc. cit.*, 1930). Specimens in New Zealand museums are labelled *N. itosibi* Jordan and Evermann, a Hawaiian variety.

Family ISTIOPHORIDÆ.

Genus **Marlina** Grey, 1928.

Marlina Grey, Natural History, xxviii, 1, 1928, p. 47. Haplotype, the New Zealand form of *M. mitsukurii* = *Makaira zelandica* Jordan and Evermann.

This genus embraces the Striped Marlin Swordfishes which are well known in New Zealand, Japan, and other parts of the world, but have only recently been discovered to be quite common off the southern coasts of New South Wales in the early months of the year.

Marlina zelandica (Jordan and Evermann).

(Plate ii, fig. 3.)

Makaira zelandica Jordan and Evermann, Occas. Pap. Calif. Acad. Sci., xii, Sept. 30, 1926, p. 65, pl. xix, fig. 2. Bay of Islands, New Zealand.

Marlina zelandica Whitley, Fishes N. S. Wales (McCulloch), Ed. 3, July 9, 1934, No. 409a. Montague Is., N.S.W.—new record for Australia.

"*Striped Marlin*" of authors, N.S.W. Rod Fishers' Soc. Gazettes, 1935–37; Angling and Gun Sport, 1935–37; Sydney Mail, Feb. 5, 1936, p. 10 and fig., and in Australian newspapers.

The Striped Marlin has figured prominently in New Zealand publications, so only Australian specimens are dealt with here. They are evidently conspecific with the Bay of Islands type, such discrepancies as are noted being doubtless due to individual variation. The first example of the species actually caught in Australia was taken near Montague Island, New South Wales, on February 12, 1934; its head is still preserved at Anthony Hordern & Sons Ltd., Sydney. In the following year and early in 1936–7, local anglers secured further specimens off the southern coastline of New South Wales, and Mr. Zane Grey, who visited Australia specially for big game fishing, caught his first Striped Marlin here on January 13, 1936. Many were thenceforward obtained, and a complete list of captures to date has been printed in the June, 1936, numbers of the N.S.W. Rod Fishers' Soc. Gazette and in Angling and Gun Sport, published in Sydney. Finally, on April 27, 1936, Mr. Grey caught a Striped Marlin of 172 lb. off Port Jackson, the most northerly Australian record. Mr. Grey and his compatriots kindly allowed me to examine their catches when I was holidaying at Bateman's Bay in March, 1936. The swords had been sawn off some of the specimens and the bony orbits removed to make inkstands and other souvenirs, but in this species the eye is constantly contained about 11½ times in the length of the snout or sword. Opinions differ as to the value of the flesh as food. Personally I considered baked fillets of Striped Marlin were rather dry and coarse, somewhat like Kingfish (*Cybium*), but a first-class chef might be able to make a tasty dish from it, or the species should be suitable for smoking. The following notes were made from fresh specimens:

Specimen A.—Br.7; D.xlii (counting fused anterior spines as one)/9, the last ray flattened; A.xiii/6, last flattened; P.i/17; V.1 (all the rays having fused inseparably). The number of caudal rays could not be determined superficially. General facies as shown in the figure. Spaced scales on cheeks. Tip of tongue rounded. Teeth persistent. Length nearly 8 feet from tip of lower jaw to end of middle caudal rays. Depth of body 15 inches, at origin of first anal 13, tapering to about 7½ between second dorsal and second anal fins. Height of first dorsal nearly 18. Base of first dorsal about 4 ft. 2 in. Origin of dorsal to base of twelfth spine 10. Length of twelfth spine 3½. Base of second dorsal 4, its height 3¾, its last ray 6. Height of first anal fin 12, its base a little longer. Second anal a little smaller than second dorsal. Origin of first anal to that of second anal 16. Only a couple of inches of interdorsal space. Pectoral 20½. Tip of adpressed pectoral to anal origin about 11½. Right ventral fin 13½. Left ventral fin 10. Upper caudal lobe 26. Lower caudal lobe 23½. Distance between caudal tips 38. Length of median part of tail 8. Caudal keels 3. Caudal peduncle 7 above and 8 below. The tip of the lower jaw is on a horizontal level with the upper part of the operculum and the upper half of the eye. Body robust, somewhat compressed laterally. The greatest depth is between the dorsal sheath and the ventral fins. A groove along middle of belly reaching from ventral fins almost to the vent, which is some distance in advance of the anal fin. The high dorsal lobe is formed by the first eight spines or so. The twelfth spine is about one-fifth of the distance along the base of the fin, and is the first of the low spines continuing to the end. First anal fin triangular, its last spines short and in a groove; anal base little longer than its height. Base of second anal fin a trifle in advance of that of second dorsal.

General colour after death greyish or steel-blue, becoming silvery or white ventrally. Body crossed by about thirteen irregular short bars, some of which tend to break up into spots. On the back near the base of the dorsal fin there is brilliant blue iridescence and the spinous dorsal fin is milky blue to dark blue, also with iridescence. Some peacock blue on the last ray of the second dorsal, which is dull blue-grey.

Specimen B.—Caught by Mr. Grey, March 17, 1936. In most respects like *A*, but the head measurements may be noted, together with some variations. Sword, measured from orbit, 26 inches. It sticks up and points a little to the right (taxidermists tell me that no swordfish has the sword pointing exactly forwards, and that the fins, sticking out at various angles, prohibit mounting them in a small space). Orbit 2¼ inches vertically and horizontally. Pupil $1\frac{1}{16}$. Interorbital 6½. Eye to nostril 1⅛. Nostril less than ½ in. Distance between nostrils 5⅜. Lower jaw's tip nearly 15 in. from the end of maxillary. Sword nearly 16 in. beyond end of lower jaw. Top of eye to upper profile of head 1 inch between parallels. Lower ocular margin to upper edge of maxillary ¾. Length of maxillary groove

4¼; it extends 2 inches behind the vertical of the posterior margin of the eye. Orbit to angle of preoperculum 6. No rugose area behind operculum as in Jordan and Evermann's figure. Postorbital length 9½. Upper corner of operculum to origin of dorsal fin 5¼. Height of spinous dorsal 17. Origin of first dorsal in advance of that of pectoral, which is again anterior to the ventrals. Gill-membranes united across the rather broad isthmus. Distance between pectoral fins 7. Each pectoral fin has one flat spine and eighteen rays. Length of pectoral 17½. Thus the pectoral is only a little longer than the dorsal lobe; it is of a dirty greyish or brown colour (not black). No sharply defined boundary between light and dark portions of flanks. In proportions of sword and rest of head, dorsal and pectoral lengths, and colour of dorsal fin, this specimen does *not* agree with Jordan and Evermann's key characters and seems nearer the Japanese *M. mitsukurii.* The ventral fins were asymmetrical, measuring 10 and 10¼ inches, and were inserted 28 inches from the vent.

Other Specimens.—Another example of the Striped Marlin had eight branchiostegal rays and a very small rugose patch behind the gill-opening. Practically every specimen had parasitic crustacea (*Caligus* sp.) attached to the flanks, generally clustered near the anal fin, where the integument was somewhat abraded.

The largest Bateman's Bay specimen seen by me weighed 250 lb., and had a sword of 2 ft. 3¼ in., and eye nearly 2½ in. Two others, caught by Mr. R. Fagan, were 200 lb. in weight, with swords 25 in. and eye 2¼. The largest Striped Marlin so far caught in Australia was the Bermagui specimen hooked by Mr. Zane Grey in February, 1936, the weight of which was said to be 385 lb., but much larger examples have been caught in New Zealand, where the record fish was 13½ feet long and weighed 820 lb. A female caught in the Bay of Islands, New Zealand, on February 28, 1935, was recorded[21] as having well filled ovaries, but it is disappointing to observe how the game fishermen discard the carcasses of their captures without examining their stomach contents or reproductive organs. None of the Bateman's Bay marlin seen by me was in roe, but their stomachs contained Leatherjackets (*Nelus vittatus*) and other fishes (*Trachurus*, etc.). The Striped Marlin inhabits open ocean waters, so that when rain and floods made the inshore waters too fresh and disturbed, anglers had to travel more than 14 miles out to sea before encountering any swordfish.

Family ISTIOPHORIDÆ.

Genus **Istiophorus** Lacépède, 1802.

Istiophorus albicans (Latreille).

Makaira albicans Latreille, Nouv. Dict. Hist. Nat., Ed. 1, xxiv, March 7, 1804, p. 104. Latinization of "le Makaira blanchâtre" Bosc, *ibid.*, Vol. xiii, Aug. 12, 1803, p. 558. Vernacular name for a sailfish figured in Marcgrave's *Brazil*, p. 171.

Histiophorus americanus Cuvier and Valenciennes, Hist. Nat. Poiss., viii, '1831', = Jan., 1832, p. 303. Likewise based on Marcgrave's figure.

Makaira albicans is the earliest name for an American swordfish and replaces the later *Histiophorus americanus.* Latreille's name has been overlooked by authors and is not in Sherborn's "Index Animalium". The present species was recently added to the British fauna by Norman,[22] and should now be known as *Istiophorus albicans* (Latreille).

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[21] Lindauer.—Nature, Nov. 16, 1935, p. 797.

Family GOBIIDÆ.

Genus **Ellogobius** Whitley, 1933.

Ellogobius Whitley, Rec. Austr. Mus., xix, 1933, p. 92. Orthotype, *Gobius stigmaticus* De Vis.

Small dull-coloured gobies of normal facies found in shallow muddy creeks along the eastern Australian coastline. The head is naked or else with a few scales on the operculum. The teeth are villiform. There are no barbels or fleshy lobes on the head, and none of the pectoral rays is free and silk-like. Six dorsal spines. Caudal fin rounded. Body covered with ctenoid scales which are largest posteriorly and are in more than forty transverse rows.

Ellogobius abascantus, sp. nov.

(Figure 4.)

D.vi/8(9); A.10; P.16; V.i/5; C.15. Sc. *circa* 52 on left side and 60 on right. L.tr. *circa* 15.

Head (10 mm.) 3·8, depth of body (5·5) about 7 in standard length (38). Eye (2) subequal to snout (2) and about 5 in head.

Head broadly rounded when viewed from above, bluntly rounded from the side. Eyes moderate, superolateral. Interorbital broad, sunken. Nostrils tiny, circular, the anterior over upper lip. Skin of head naked; mucous papillæ reduced or absent. Snout terminal, blunt, subequal to eye. Mouth rather large, reaching to below posterior part of eye. Lips sinuate. Each jaw is furnished with a band of fine villiform teeth. A broad velum maxillare. Tongue with a very shallow notch anteriorly. Gill openings separated by a wide isthmus.

Form of body subcylindrical anteriorly, becoming compressed posteriorly. The ventral surface of the thorax is sunken and rather concave. Body covered with cycloid scales, which are small anteriorly but become larger on the caudal peduncle. There appear to be no scales on the back before the dorsal fin, nor on the breast or pectoral base. A prominent anal papilla. A few upright mucous ridges behind the pectoral fins. Depth of caudal peduncle less than half length of head.

First dorsal with six flexible spines. Second dorsal and anal similar and opposite to one another. Pectorals and caudal rounded, shorter than head. No

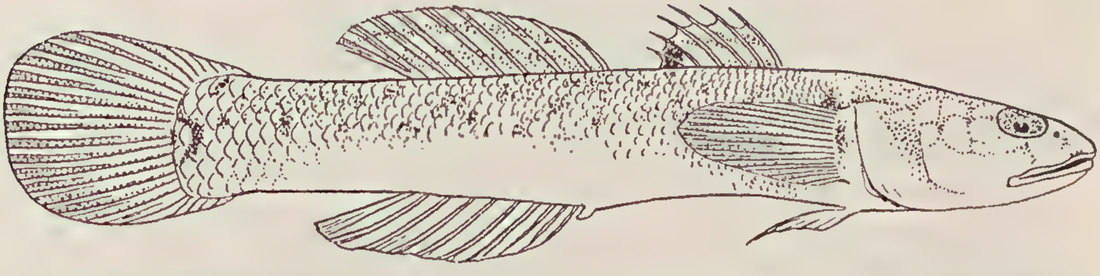

Fig. 4.—*Ellogobius abascantus* Whitley. Holotype, 38 mm. in standard length, from Bateman's Bay, N. S. Wales.

G. P. Whitley, *del.*

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[22] Norman.—Nat. Hist. Mag., ii, 9, 1927, p. 32 and figs.; Journ. Mar. Biol. Assoc. U.K. (n.s.), xvi, 1, 1929, p. 67, 2 figs.

silk-like upper pectoral rays. Ventrals not adnate to body, but united to one another and with a frenum.

Colour, in alcohol, very pale dirty yellow or cream, overlain by numerous indistinct and broken sooty blotches on the upper half of the fish. A reticulated pattern of fuscous chromatophores behind the eye. A dark blotch on operculum, one on the posterior dorsal spines, and, most conspicuous of all, an irregular blackish blotch at root of caudal fin. Most fin-rays with a double series of fine black dots. A pale orange smudge along thorax ventrally. Eyes and snout dull bluish.

Described and figured from the holotype of the species, the largest of three specimens, 38 mm. in standard length or about 1¾ inches over all. Austr. Mus. Regd. No. IA.6850.

Locality.—A very shallow brackish creek near the Hanging Rock camping ground at Bateman's Bay, New South Wales, March 22, 1936. Collected by G. P. Whitley. Holotype and paratypes.

A small *Favonigobius* and an *Anguilla australis* were caught at the same time.

In McCulloch and Ogilby's revision of some Australian fishes of the family Gobiidæ, this species comes nearest the one they name *Mugilogobius devisi*[23] from Moreton Bay, Queensland, but differs in fin formula, more diffuse coloration, and more elongate form, besides having smaller scales. *Mugilogobius devisi* McCulloch and Ogilby is equivalent to *Ellogobius stigmaticus* (De Vis), the orthotype of this genus, and I have examined the original type specimens.

A specimen of my new form, *E. abascantus*, was collected by Mr. M. E. Gray in a stormwater channel in a mangrove swamp at Hen and Chickens Bay, Concord, near Sydney, N. S. Wales, on September 4, 1935. Austr. Mus. Regd. No. IA.6508. It has about 60 transverse rows of scales and the body markings form about ten fairly regular lateral blotches.

Apparently *E. stigmaticus* is the northern and *E. abascantus* the southern Peronian representative of the genus. I have collected boldly marked *E. stigmaticus* at Lindeman Island, Queensland (IA.6559–60).

Genus **Obtortiophagus** Whitley, 1933.

Obtortiophagus Whitley, Rec. Austr. Mus., xix, 1, Aug. 2, 1933, p. 90. Orthotype, *O. koumansi* Whitley.

Obtortiophagus koumansi Whitley.

Obtortiophagus koumansi Whitley, Rec. Austr. Mus., xix, 1, Aug. 2, 1933, p. 90, pl. xi, fig. 3. Hayman Island, Queensland. Holotype (No. IA.2027) in Austr. Mus., Sydney.

Callogobius ocellatus Herre, Field Mus. Nat. Hist. (Zool.), xviii, 12, Feb. 15, 1935, p. 422 *et ibid.*, xxi, April 15, 1936, p. 362, fig. 23. Ovalau Island, Fiji Islands. Holotype (No. 17363) in Field Museum of Natural History, Chicago.

The species recently described from Fiji by Herre seems closely allied to *Obtortiophagus koumansi*; it has somewhat smaller scales than the Australian form and slightly different colour-markings, but these may be variable. The two are certainly congeneric and very probably conspecific. Herre placed his fish in the genus *Callogobius* Bleeker, 1874, from which *Obtortiophagus* shows the following salient differences:

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[23] McCulloch and Ogilby.—Rec. Austr. Mus., xii, 10, July 14, 1919, p. 223, pl. xxxvi, fig. 2.

A. Head with papillæ in prominent ridges; similar ridges are also on sides of body. Interorbital fairly broad. Scales large, cycloid, or only ctenoid posteriorly. Ventral fins with frenum weakly developed .... *Callogobius*, s. str.

AA. Head with short inconspicuous rows of papillæ; no ridges on sides of body. Interorbital narrow. Scales small, ctenoid. Ventrals infundibuliform .... *Obtortiophagus*

GELIDIDÆ, fam. nov.

A family of fishes of obscure relationship to others, but remotely resembling the Percophidiformes. From these, it is easily distinguished by means of the fine weak dentition, the almost scaleless head, and very large eyes. In superficies it suggests an elongate Apogonoid which has developed the fleshy texture of some of the deep-sea Iniomi.

Gelidus, gen. nov.

Orthotype, *Gelidus antarcticus* (Boulenger).

Head pointed, compressed, with thin papery bones. Maxillary extending obliquely almost to below middle of eye, its posterior margin broadly truncate. Premaxillary long and narrow, the length of its processes equal to half the diameter of the eye. Lower jaw slightly the longer. Bands of fine hooked teeth on jaws, largest at premaxillary symphysis and on sides of mandibles. Vomer and palatines without teeth. Tongue thick and fleshy, toothless, and obliquely truncate anteriorly. Chin horseshoe-shaped from below; some large pores below lower jaw. Nostrils subcircular, close together on each side of the snout. Eyes very large, their diameter greater than interorbital space. Opercular bones thin and papery, crossed by very fine striæ. One or two vestigial cycloid scales on cheeks near eye. Seven branchiostegal rays. Gill-membranes united across the narrow isthmus. Gill-rakers long and narrow, about eighteen on lower half of first branchial arch. Pseudobranchiæ present. Large pores along preopercular margin and nuchal region. Ten predorsal scales, not reaching eyes.

Body elongate, compressed, tapering posteriorly to a constricted caudal peduncle and a rather square caudal root. It was evidently covered by large cycloid scales, but most of these, being deciduous, have left only scale-pockets to show their size and extent. There are scales on the breast and the base of the pectorals, but none on the fins. Lateral line extending from near opercular flap to tail along middle of sides. Two dorsal fins, the first composed of seven weak spines; the second fin very long, but not so long as the anal. Vent in anterior half of fish. Pectorals pointed, about half length of head. Ventrals situated well forward, consisting of a spine and five long rays. Caudal apparently forked. This new generic name is proposed to replace *Pleuragramma* Boulenger[24] preoccupied by *Pleurogrammus* Gill,[25] another genus of fishes. The type species of *Gelidus* was originally described as *Pleuragramma antarcticum* by Boulenger, who placed it in the Leptoscopidæ, with which it appears to have no relationship whatever; hence my new family name. For helpful advice as to the specific identity of this fish I am indebted to Dr. Carl Hubbs, of Michigan, and Dr. J. T. Nichols and Miss F. LaMonte, of New York.

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[24] Boulenger, Rept. Coll. Nat. Hist. Southern Cross, Pisces, 1902, p. 187. Haplotype, *P. antarcticum* Boulenger.

[25] Gill, Proc. Acad. Nat. Sci. Philad., 1861, p. 166 (Hexagrammidæ).

Gelidus antarcticus (Boulenger).

(Figure 5.)

Pleuragramma antarcticum Boulenger, Rept. Coll. Nat. Hist. Southern Cross, Pisces, 1902, p. 187, pl. Victoria Land. *Id.* Boulenger, Cambr. Nat. Hist., 1904, p. 705. *Id.* Regan, Trans. Roy. Soc. Edinb., xlix, 2, 1913, p. 264, and Brit. Antarct. Terra Nova Exped., Zool., i, 1, 1914, p. 6, *et ibid.*, i, 4, 1916, p. 131, pl. ii, figs. 3–6. *Id.* Totton, Proc. Zool. Soc. Lond., 1914, p. 251, pls. i-ii (caudal devel.). *Id.* Waite, Austr. Antarct. Exped. Fish., 1916, p. 22. *Id.* Nichols and LaMonte, Amer. Mus. Novit., 839, 1936, p. 1.

Br.7; D.vii/35; A.38; P.21; V.i/5; C.13. Sc. *circa* 50. L.tr.5/1/7 or 8?. Ten predorsal scales.

Head, allowing for some apparent shrinkage of the snout (47 mm. long), 3·7 in length without caudal fin (174); depth of body (25) nearly 7 in same. Eye (15) 3·1, snout (12) nearly 4, interorbital space (9) 5·2, maxillary (19) 2·4 in head. Last anal ray minute.

General characters as described for the genus.

Colour, after preservation, pale yellowish, with dark areas of large scattered black chromatophores along back and middle of sides. Eye and viscera dark blue. Top of head brownish. Some of the fin-rays and most of the caudal root infuscated.

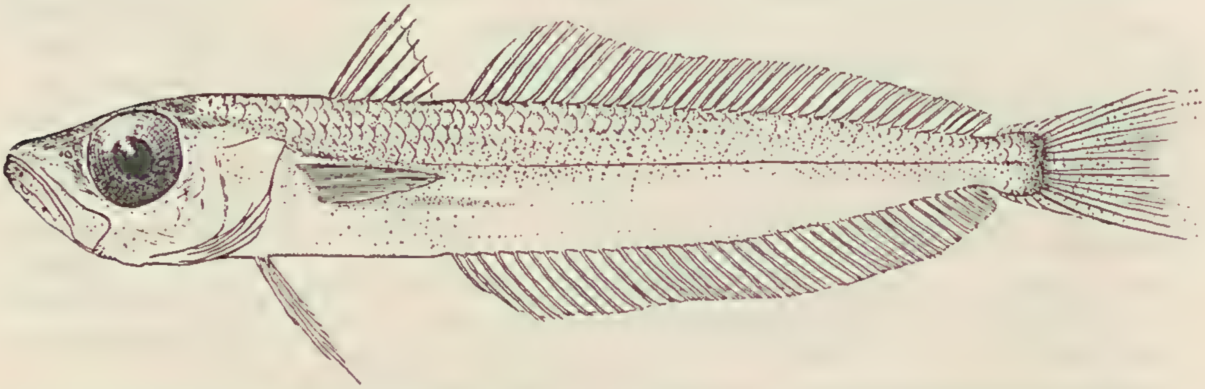

Fig. 5.—*Gelidus antarcticus* (Boulenger). A specimen, 174 mm. in standard length, from Bay of Whales, Antarctica.

G. P. Whitley, *del.*

Described and figured from a specimen 174 mm. in length without caudal, or about eight inches over all.

Locality.—Bay of Whales, Antarctica; taken, with others, from the stomach of a Weddell Seal (Byrd Expedition).

Family BLENNIIDÆ.

Genus **Blennius** Linné?

Blennius maoricus Kner.

Blennius maoricus Kner, Sitzungsber. Akad. Wissen. Wien., li, 1, 1865, p. 503, and Reise "Novara", Zool., i, Fische (2), 1865, p. 195, pl. viii, fig. 3. Auckland, New Zealand.

This Blenny was described and figured by Kner in 1865, and does not appear to have been discussed since. Its type locality was given as Auckland, yet the species does not appear in any of the several lists of New Zealand fishes. Possibly the record was erroneous.

Family CHEILODACTLIDÆ.

Genus **Sciænoides** Richardson, 1843.

Sciænoides valenciennesi, sp. nov.

Cheilodactylus carponemus Cuvier and Valenciennes, Hist. Nat. Poiss., v, July, 1830, p. 362, pl. cxxviii. Australian specimens only. Not *C. carponemus* Cuvier, Règne Anim., Ed. 2, ii, 1829, p. 177, a new name for *Cichla macroptera* Bloch and Schneider, which is a different species of *Sciænoides* from New Zealand.

The Western Australian Morwong usually called *carponemus* requires a new name, as above, and King George's Sound is selected as type locality of *Sciænoides valenciennesi*, nom. nov. The name *Sciænoides aspersus* (Richardson) may be employed for the Hobart form mentioned by Cuvier and Valenciennes.

Family OPISTOGNATHIDÆ.

Genus **Tandya** Whitley, 1930.

Tandya Whitley, Mem. Qld. Mus., x, 1, August 28, 1930, p. 19. Orthotype, *Opisthognathus maculatus* Alleyne and Macleay.

Tandya latitabunda, sp. nov.

(Plate ii, fig. 2.)

Tandya sp. ? Roughley, Wonders of the Great Barrier Reef, 1936, p. 272, pl. xlix, fig. 1. (Capricorn Group, Queensland.)

Br.6. D.xii/18; A.i/15; P.i/20; V.i/5; C.12. L. lat. reduced, *circa* 50. About 80 transverse rows of scales between shoulder and hypural joint. L.tr. 0 + 5/1/26, near end of lateral line, or 9 + 9 on caudal peduncle. 16 gill-rakers on lower limb of first branchial arch.

Head (82 mm.) 2·6, depth of body (68·5) 3·1, depth of caudal peduncle (25) 8·6 in standard length (215). Interorbital (6) 3·6, preorbital (4·5) nearly 5 in the eye (22), which is 3·7 in head.

Height of anal fin (33) subequal to that of soft dorsal (34) and less than length of pectoral (40) or caudal, measured from hypural joint (46).

Head bulbous, naked; upper profile evenly convex, lower flat. Mouth cavernous, the maxillaries extending about halfway along the postorbital part of the head, all the supplemental bone lying well behind the eye; there is no backward lamina as in *Opistognathus*.[26] The eyes are very large, almost circular, and separated by a concave interorbital. Anterior nostrils with a broad posterior flap; posterior nostrils with low rims. A single row of spaced canines, some almost 3 mm. long, in both jaws, thirty more or less on each side of each jaw. Behind these is a second row of a few peg-like teeth near middle of jaws, but there are no villiform teeth, nor any teeth at all at the symphyses, or on the vomer, palatines and tongue. There are, however, more peg-like teeth on the bones at the entrance of the pharynx. Mandibular rami roundedly elevated. Opercles unarmed, the preopercular margin rounded and the opercle ending in an acute flap. Gill-openings wide, their membranes united across the narrow isthmus. Gill-rakers slender and finely denticulated, the longest about equal to diameter of pupil.

Body compressed, slightly tapering. Except near the anterior dorsal spines and the nuchal region and on the breast and around the paired fins, it is covered by close-set cycloid scales which are firmly embedded. The lateral line is weakly developed as a row of about fifty scales extending from the upper angle of the gill-opening along the top of the sides to below the anterior slit dorsal rays. The anal region is naked, with puckered skin, and there is a fairly prominent papilla.

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[26] *Opistognathus* Cuvier, Règne Animal, Ed. 1, ii, "1817" = Dec., 1816, p. 252. Haplotype, *O. sonnerati* Cuvier, from "la mer des Indes".

Dorsal fin originating over the upper angle of the gill-opening. The spines are simple, weak, not bifurcated and are shorter than the rays which form a rounded soft dorsal fin. Anal similar to soft dorsal. Some of the rays have small cysts on their sides, perhaps caused by parasites. Pectorals and caudal broadly rounded. Ventral fins approximate, jugular, their rays rather thickened and finger-like.

Colour after preservation in alcohol: Head mostly smoky greyish-brown, darkest anteriorly, not spotted. Fuscous areas on jaw membranes and inside the mouth, except that the tongue is white. An oblique brown streak below opercular flap. Eyes dark bluish. Teeth white.

Ground-colour of body dirty white or yellowish, the scales densely infuscated by large brown chromatophores. There is a large blackish ocellus on the shoulder, with a white or yellow centre and ring around it. This is followed on the body by several smaller oval or bean-shaped black blotches, each surrounded by a light area. Five similar marks extend along the base of the dorsal fin and the back, and their superior whitish auras contrast with the smoky margins of the dorsal fin. A dark blotch above and below the caudal peduncle, and some smaller similar marks on caudal. Anal fin uniform smoky except for a small dark blotch on last ray. Paired fins lighter greyish or yellowish, uniform, except that tips of ventral rays are dusky.

Described and figured from the unique holotype, a specimen 215 mm. in standard length or 10¼ inches overall. Australian Museum Regd. No. IA.6958.

Locality.—Port Newry, north of Mackay, Queensland. Purchased from Mr. Charles Volskou, of Mackay.

This new species is allied to the genotype, *Opisthognathus maculatus* Alleyne and Macleay,[27] which has been fully dealt with by Ogilby[28] in his excellent revision of Opistognathidæ, but differs as follows, as shown by direct comparison:

A. Teeth in several rows. Head spotted. Lateral line extending to below 10th dorsal ray. Depth about one-fourth of standard length. Body with many small spots . . Holotype of *Batrachus punctatulus* Ramsay = *Tandya maculata* (A. & M.)

AA. Teeth in a single row, except for a few supernumerary ones. Head not spotted. L.lat. extending to below 4th or 5th dorsal ray. Depth about one-third of standard length. Body with a few large dark blotches .... Holotype of *Tandya latitabunda*, sp. nov.

Family PARAPERCIDÆ.

Genus Enigmapercis Whitley, 1936.

Orthotype *Enigmapercis reducta*, Whitley.

A genus of small fishes of the series Percophidiformes, in which the spinous dorsal fin is reduced to a couple of small spines connected to the back by membrane and well separated from the soft dorsal fin. It differs from *Acanthaphritis* Günther[29] in these respects and in having a lower soft dorsal, pointed caudal, longer snout, etc., as described below. *Pteropsaron* Jordan and Snyder[30] and *Osopsaron* Jordan and Starks[31] are similarly distinct.

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[27] Alleyne and Macleay.—Proc. Linn. Soc. N. S. Wales, i, Feb., 1877, p. 280, pl. ix, fig. 3.

[28] Ogilby.—Mem. Qld. Mus., vii, 1920, p. 27, pl. iii.

[29] Günther.—Rept. Voy. Challenger, Zool. i, 6, 1880, p. 43. Haplotype, *A. grandisquamis* Günther, from the Ki Islands.

Enigmapercis reducta Whitley.

Enigmapercis reducta Whitley, Proc. Roy. Zool. Soc. N. S. Wales, 1935–6 (Aug. 25, 1936), p. 19 (prelim. description).

Br.7. D.ii/18; A.24; P.16; V.i/5; C.11. L.lat.37. L.tr.2/1/4. Predorsal sc. 12.

Head (16mm.) 3·4, depth of body (6) 9 in standard length (55). Eye (3) equal to snout (3), 2 in upper jaw (6). Pectoral fin (13) equal to caudal (13). Ventral fin (7) slightly longer than longest dorsal ray (6·5), which is again longer than the average anal ray (6).

Head depressed, the snout somewhat pointed. Top of head not bony. Mouth not steeply oblique. The premaxillary is flattened and projects over the lower jaw. The maxillary reaches backwards to below the anterior half of the eye, its extremity being slightly excavated.

A single narrow row of very fine acute teeth in each jaw and on the palatines. They appear to extend over the vomer, where they are very minute.

A velum maxillare present. Tongue spatulate.

Snout truncate anteriorly when viewed from above; from a lateral view the physiognomy is rather like that of a *Callionymus*. Nostrils circular, relatively large, superior. Eyes ovate, superior, separated by a very narrow interorbital groove. Preoperculum rounded, entire, with a few mucous tubes near its margin. Operculum with a rounded backward flap. Cheeks, opercles and vertex scaly. Gill-rakers apparently vestigial. Gill-membranes attached to the narrow isthmus.

Body elongate, rounded anteriorly and compressed posteriorly, where it tapers slightly. It is covered with very large cycloid scales. There is a complete, single, median lateral line consisting of scales with a simple tube and a shield-shaped marginal notch.

First dorsal reduced to a small fin of two spines, of which the first is longer and stronger than the second. There are four scales along the interdorsal space. The soft dorsal fin is much higher than the spinous and consists of one simple and seventeen branched rays. The anal fin commences below the posterior part of the spinous dorsal and consists of branched rays throughout, the majority of them being feather-like. Upper pectoral rays short, the fourth and fifth very long and the others diminishing in length. The pectorals are quite distinct from the ventral fins which are well separated, their fourth rays longest. Caudal fin pointed.

The ground-colour is white to pale yellowish, with an irregular very pale milky bar along the middle of each side. There are about seven yellowish to pale brown cross-bars over the back, where each scale is brown or orange-edged and the last cross-band is dark brown, forming a conspicuous blotch on the upper half of the caudal peduncle. On the upper part of the sides of the body, roughly corresponding with the dorsal cross-bars, is a series of rich brown irregular blotches, and below the lateral line are about five very indistinct small yellow blotches. The head is mottled brownish above and, like the body, white below, but with some faint yellow on cheeks. Fins mostly whitish or with faint washes of yellow, but the spinous dorsal is mostly black and the caudal is transversely banded with yellow and pale brown. Eye metallic bluish.

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[30] Jordan and Snyder.—Proc. U.S. Nat. Mus., xxiv, 1902, p. 470. Orthotype, P. *evolans* Jordan and Snyder, from Japan.

[31] Jordan and Starks.—Bull. U.S. Fish. Comm., xxii, 1904, p. 600. Orthotype, *Pteropsaron verecundum* Jordan and Snyder, from Japan.

Described from the holotype, a specimen 55 mm. in standard length, or 2⅝ inches overall.

Locality.—Off Long Reef, Collaroy, New South Wales. Dredged in 14 fathoms on a gravel and shell bottom, by Messrs. C. F. and John Laseron, August 9, 1936. Australian Museum Regd. No. IA.7024.

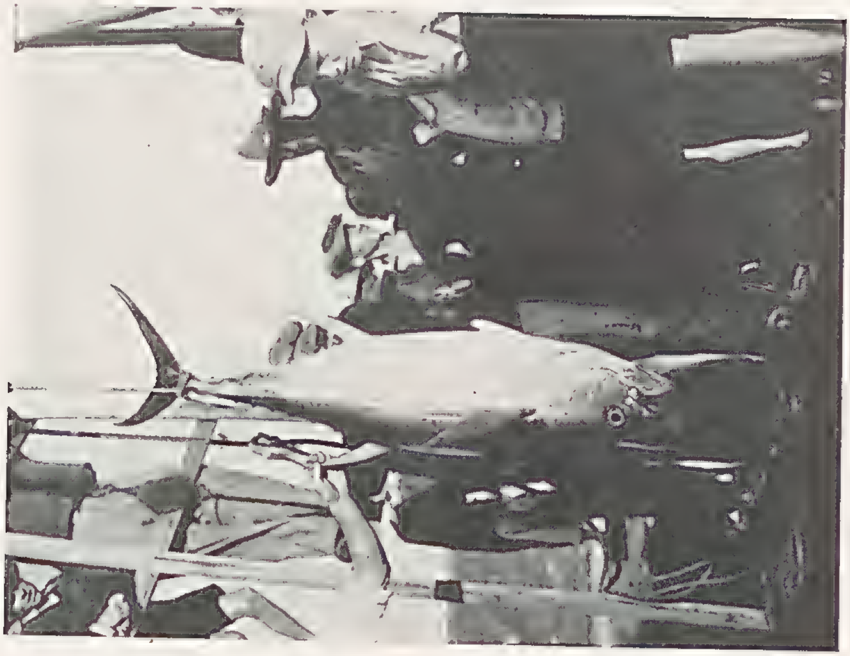
This specimen was brought to the Museum alive in a small bottle, together with dredged gravel and shells, which it imitated in coloration to a surprising degree. It lay on the bottom and, to increase the disguise, placed some of the shells on its head and shoulders by flicking with its pectoral fins. It was very hardy, living for a surprising time even in formalin. The coloration described above was taken from the living fish.

EXPLANATION OF PLATE II.

Fig. 1.—*Neothunnus macropterus* (Temminck and Schlegel). A specimen, 91 lb. in weight, from off Bermagui, New South Wales.

Fig. 2.—*Tandya latitabunda* Whitley. Holotype, 215 mm. in standard length, from Port Newry, Queensland.

Fig. 3.—*Marlina zelandica* (Jordan and Evermann). A specimen, nearly 8 feet long (measured from tip of lower jaw to end of middle caudal rays), from off Bateman's Bay, N. S. Wales.



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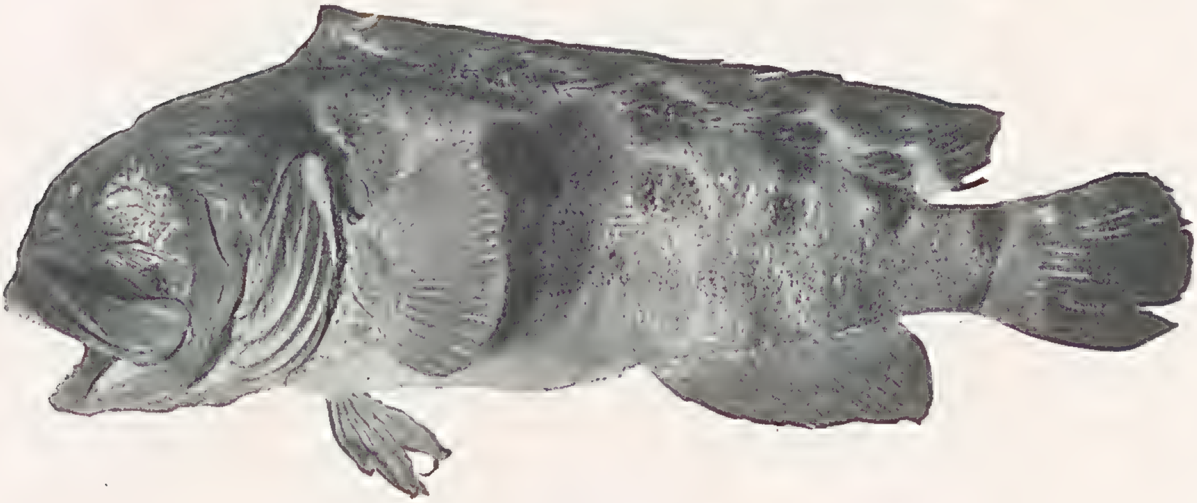

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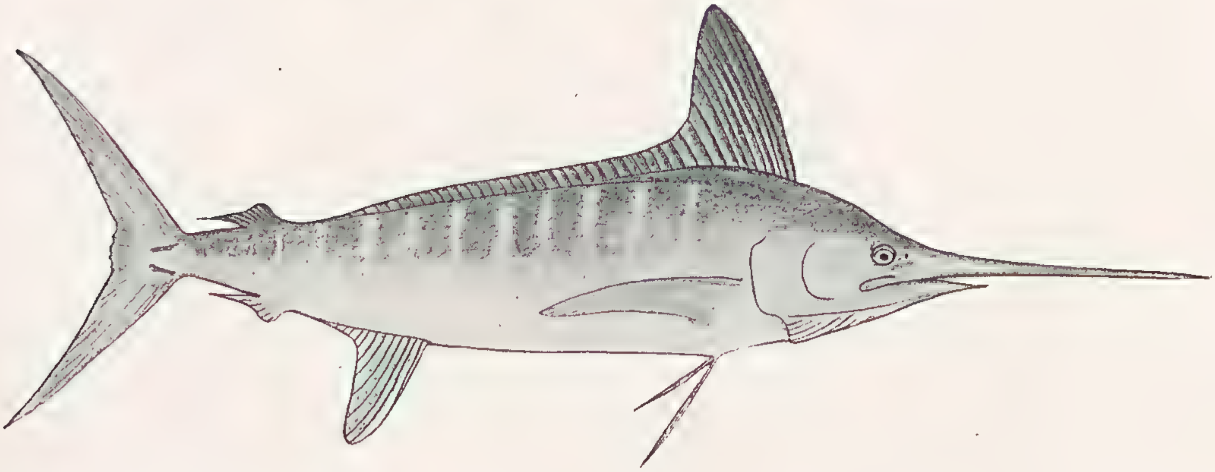

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Emil Morhardt, photo (1).
G. C. Clutton, photo (2).
G. P. Whitley, *del.* (3).

NATIONAL MUSEUM OF VICTORIA

NOTES ON AUSTRALIAN CERAMBYCIDÆ.

By

Keith C. McKeown,
Assistant Entomologist, The Australian Museum.

(Plate iii.)

Specimens in the Macleay Museum Collected during King's Survey.

Considerable doubt has existed with regard to the identity of certain species of longicorn beetles described by W. S. Macleay from material collected during King's survey of the coasts of Australia.

In the course of an examination of the Cerambycidæ in the Macleay Museum at the University of Sydney, I discovered six specimens with old labels bearing the name of Capt. King. All these labels are in the same handwriting, which appears to be identical with that of W. S. Macleay, and bear every evidence of age. The information contained on the labels agrees in all respects with the particulars given by Macleay in his appendix on the Annulosa in King's "Survey of the Coasts of Australia", ii. While the presence of one specimen might have been concluded to be accidental, the existence of six specimens may be taken as additional evidence of their authenticity. Any doubt which existed was, however, removed by careful comparison of each specimen with the original descriptions, with which they have been found to agree in each case, so that I have no hesitation in accepting them as authentic specimens collected by Capt. P. P. King's expedition and described by W. S. Macleay, and, in the absence of other material, they may be considered to be the types of the species concerned.

Some of the confusion has, no doubt, been due to the fact that Macleay placed three of the species under the generic name of *Callidium*, although they are representatives of three very distinct genera, viz., *Pytheus*, *Phacodes*, and *Hylotrupes*, and no subsequent worker seems to have realized their true position. *Callidium erosum* Macl. is listed, among others, in the Junk Catalogue by Aurivillius as "Genus ?", with the footnote, "Species described as *Callidium*, but of which the generic, or, indeed, the systematic position, is uncertain." All reference to Macleay's record of *Callidium bajulus* L. has been omitted from the catalogues, the identification being, probably, considered to be erroneous. Macleay considered that his *Callidium solandri* (so-called) was identical with the Fabrician insect, a species to which it bears no resemblance. Confusion in the case of *Acanthocinus piliger* Macl. was further intensified by Aurivillius, who considered that *Probatodes plumula* Newm. and this species were synonymous.

The discovery of authentic specimens of these insects has enabled me to correct the existing synonymy, which is as set out below. In the case of each species considered I have reprinted the original description by Macleay, and where confusion between species has occurred the original descriptions of the insects with which they were believed to have been synonymous have also been included.

Captain Phillip P. King's work, "Narrative of a Survey of the Intertropical and Western Coasts of Australia Performed between the Years 1818 and 1822", is dated 1827 on the title page, but Mr. C. Davies Sherborn, in *Ann. Mag. Nat. Hist.* (8), xiii, Feb., 1914, gives the actual date of publication as 18th April, 1826.

The work of the survey was carried out by Capt. P. P. King first in the cutter *Mermaid*, and later, in 1820, in the brig *Bathurst*. From the zoological material obtained it appears that the greater part of the collecting was carried out on the north-western and west coasts of Australia, though some specimens may have been obtained from Queensland. There seems little likelihood that insects were secured in the south; it is, therefore, the more remarkable that species occurring in the vicinity of Sydney and in Tasmania should have been considered to be identical.

In the accompanying plate the insects in the Macleay Museum have been figured in the condition in which they exist at the present time, and examples of *Depsages solandri* and *Probatodes plumula* have been included for the purpose of comparison.

I have to express my sincere thanks to Mr. K. E. W. Salter, B.Sc., Curator of the Macleay Museum, for his kindness in making the material available for my examination, and to Miss N. B. Adams, Australian Museum, for the preparation of the plate, her fine and accurate drawings contributing in no small degree to the value of this paper.

Genus Phacodes Newm.

Phacodes subfasciatus Gahan.

(Plate iii, figs. 3 and 3*a*.)

Callidium solandri Macleay [*nec* Fab.], in King, Survey Coasts Australia, ii, April 18, 1826, App., p. 452.

Phacodes subfasciatus Gahan, Trans. Ent. Soc. Lond., 1893, p. 170.

This is one of the species in connection with which considerable confusion has existed owing to the inclusion by Macleay of species of widely separated genera in *Callidium*, but this confusion has been intensified by his identification of this insect as *Lamia solandri* Fabricius, an error which has been perpetuated by all subsequent workers. Macleay states: "I place Olivier's Synonym in this case first; because the Fabrician description is so erroneous, that did we not know the original insect in the Banksian Collection, there would be no possibility of making it out." It would appear from this that Macleay's recollection of the Fabrician specimen had been at fault.

There are two specimens of this insect in the Macleay Museum bearing the label: "Callidium Solandri, L. Solandri Fab. et Oliv., Captn. King, Australasia." Both specimens are damaged; the smaller, possibly a male, has one antenna wanting, while the larger specimen has the greater part of both antennæ broken off. These specimens measure 11 mm. and 14 mm. long respectively.

Gahan's description of *Phacodes subfasciatus*, with which the Macleay specimens agree very closely, is as follows:

"♀. Fusco-brunneus, cinereo fulvoque pubescens; prothorace quam latiori vix longiori, lateribus cinereo sat dense pubescentibus, disco pube grisea fulvoque sparsim vestito, medio vix evidenter carinato; elytris pube cinerea fulvoque punctis brunneis adspersis interrupta, vestitis, utrisque paullo pone apicem fascia subobliqua albido-pubescente; apicibus truncatis, haud spinosis; antennis medium elytrorum vix excedentibus. Long 10 mm.

"*Hab.*—Roebuck Bay, North-west Australia (Walker).

"Dark brown, with a pubescence which is for the most part ashy grey, but which, along the middle of the head and pronotum, alongside the suture, and near the apex of the elytra, is more or less tawny in colour. This pubescence is interrupted by the rather large scattered setigerous punctures, but is almost sufficiently thick, except in one or two places, to conceal the ordinary close punctuation of the elytra. At about the beginning of its posterior fourth, each elytron has a transverse or slightly oblique band formed of a denser and whiter pubescence than that on the rest of the surface. Immediately in front of and just behind this band, the elytron is somewhat bared of pubescence, so that its dark derm and close punctuation are visible. The prothorax is widest at about the beginning of its posterior third or fourth, and from this point its sides very slightly and gradually converge towards the apex, but more strongly converge towards the base. Its length is scarcely greater than its greatest width. The disc is without tubercles, and bears an indication of a median raised line or carina. The elytra are not wider at the base than the widest part of the prothorax; their length is to that of the prothorax as about 5 to 2; their apices are transversely truncate and unarmed. The antennæ, which are without spines, scarcely extend beyond the middle of the elytra; the third joint is longer than the fourth, and about equal in length to the first or fifth.

"This small species seems to have a relatively very large prothorax. Though the unique specimen, judged by the length of its antennæ and the form and length of the last joint, appears to be without doubt a female, yet its prothorax is as wide as the elytra, and considerably more than one-third as long."

It is significant that the type locality of Gahan's specimen is Roebuck Bay, North-west Australia, one of the localities visited by King's expedition.

Lamia solandri Fab., with which Macleay identified his insect, appears to be adquately covered by Fabricius' description (*Syst. Ent.*, p. 177):

"L. thorace subspinoso, nigro, elytris bidentatis, fucsis, cinereo irroratis.

"Habitat in Nova Hollandia. *Mus. Dom. Banks.*

"Magnitudo L. bidentis. Antennæ mediocres nigræ. Thorax cylindricus, subrugosus, niger, antice utrinque spinula brevissima, acuta. Scutellum nigrum. Elytra punctata, nigra, cinereo irrorata, basi punctata, humeri gibbo apice bidentata. Pedes nigri, plantis fuscis."

The shape of the apices of the elytra alone should have been sufficient to separate these insects from the descriptions, apart from other points of difference, those of *P. subfasciatus* being transversely truncate and unarmed, while those of *D. solandri* are clearly stated to be "bidentate".

It is very probable that the Fabrician specimen of *L. solandri* was collected by Banks or Solander at Botany Bay, New South Wales, and it is of interest that a large proportion of the specimens in the Australian Museum were secured at Long Bay, N. S. Wales, where they breed in the stems of the grass-trees (*Xanthorrhœa*).

The synonymy of *Depsages solandri* (Fabricius) is as follows:

Depsages solandri (Fabricius).

(Plate iii, figs. 6 and 6*a*.)

Lamia solandri Fabricius, Syst. Ent., 1775, p. 177.

Lamia solandri Fabricius, Spec. Ins., 1781, p. 225.
Lamia solandri Fabricius, Mant. Ins., i, 1787, p. 142.
Lamia solandri Gmelin, in L. Syst. Nat., Ed. 13, i, 4, 1790, p. 1829.
Lamia solandri Olivier, Encycl. meth., vii, 1792, p. 468.
Lamia solandri Olivier, Ent., iv, nr. 67, 1795, p. 100, t. 16, fig. 118.
Lamia solandri Fabricius, Syst. Eluth., ii, 1801, p. 304.
Lamia solandri Boisduval, Voy. Astrolabe, Ent. ii, 1835, p. 526.
Symphyletes solandri Froggatt, Proc. Linn. Soc. N. S. Wales (2), ix, 1894, p. 115 (Biology).
Depsages solandri Aurivillius, Cat. Coll. (Junk), pars. 73, Jan. 15, 1922, p. 269.

Hab.—Its distribution appears to be confined to the coastal districts of south-eastern New South Wales.

Genus **Pytheus** Newman.

Pytheus erosus (Macleay).

(Plate iii, fig. 1.)

Callidium erosum Macleay, in King's Survey Coasts Australia, ii, 18, April, 1826, App. p. 452.
Brachytria latebrosa Newman, Entomol., i, 1841, p. 95.

One specimen in the Macleay Museum, Sydney, labelled "Callidium erosum McL., Captn. King, Australasia". It is identical with *Pytheus latebrosus* (Newman).

Callidium erosum Macleay is listed by Aurivillius, Cat. Coll. (Junk), pars. 39, Feb. 28, 1912, p. 357, Callidiini, under the heading "Genus ?", with a footnote, "Species described as *Callidium*, but of which the generic or, indeed, the systematic position is uncertain."

When applied to *Pytheus latebrosus*, Macleay's description becomes quite clear:

"*Callidium erosum* (n.s.) C. nigrum capite punctato, ore testaceo, antennis apice, fuscis thorace tomentoso punctato vel potius punctis confluentibus eroso, disco rufo medio subtuberculato, elytris acuminatis apice deflexis lineis duabus elevatis interstitiis punctis confertissimis pulcherrimé erosis suturâ margineque rufis, corpore subtus pedibusque tomentosis."

Since Macleay's description antedates that of Newman by fifteen years, *Pytheus erosus* has priority, and the synonymy stands as above.

Genus **Hylotrupes** Serv.

Hylotrupes bajulus (Linnæus).

(Plate iii, fig. 5.)

This is a common European species, described by Linnæus in 1758 (Syst. Nat., Ed. 10, p. 396).

One specimen in the Macleay Museum is labelled, "Callidium bajulus? var. with 8 spots, Captn. King, Australasia". It is in very abraded condition, but there is no doubt as to its identity. Little trace remains of the eight white spots; six are, however, visible. It agrees perfectly with the published descriptions of *Hylotrupes bajulus*, and has been compared with a specimen in the Australian Museum. In Europe this species is recorded as being very variable.

It would be interesting to know how this specimen came to be secured by King. It is possible that it bred out from new timber embodied in the construction of the "Mermaid", which he states as "not quite twelve months old", or from timber carried among her stores. The available evidence is not sufficient to justify the inclusion of this species in the Australian list; it is obviously of accidental occurrence.

Genus Platyomopsis Thomson.

Platyomopsis piliger (Macleay).

(Plate iii, fig. 4.)

Acanthocinus piliger Macleay, in King's Survey Coasts of Australia, ii, April 18, 1826, App. p. 452.

Lamia pulverulens Boisduval, Voy. Astrolabe, Ent., ii, 1835, p. 501.

Symphyletes vetustus Pascoe, Ann. Mag. Nat. Hist. (3), ix, 1862, p. 464.

Saperdopsis armata Thomson, Syst. Ceramb., 1864, p. 53.

Saperdopsis pulverulens Aurivillius, Ent. Tidskr., xiv, 1893, p. 167.

Platyomopsis pulverulens Aurivillius, Cat. Col. (Junk), pars. 73, Jan. 15, 1922, p. 267.

There is one specimen in the Macleay Museum, Sydney, with the label, "Acanthocinus piliger, Capt. King, Australasia".

On examination, it was at once apparent that this insect was not a member of the genus *Probatodes*, in which it is placed by Aurivillius in the Junk Catalogue, but is a *Platyomopsis*. Careful comparison with the description of *Platyomopsis pulverulens* (Boisduval) and with specimens of that species in the Australian Museum, proved them, beyond all doubt, to be identical. Reference to the original descriptions will make this clear. W. S. Macleay's description reads as follows:

"*Acanthocinus piliger* (n.s.) A. antennis obscuris pilosis apicem versus cinereo-annulatis, capite cinereo vertice nigro bilineato, thorace obscuro cinereo inæquali postice subcaniculato medio utrinque tuberculato, eytris obscuris fasciculis minutis nigris flavis cinereisque variegatis, fasciâ mediâ cinereâ undatâ cristâque tuberculata humeros versus."

Boisduval's description of *L. pulverulens* reads:

"Oblonga, pallide cinerea; thorace lateribus albido, tenue tuberculato, subplicato; elytris apice tomentosis, fascia media sinuata, obsoleta, pallidiori, punctisque nigris elevatis a basi ad medium; subtus cinereo-fulvo parce variegata.

"Oblongue, d'un cendré pâle, avec le corselet légèrement tuberculé et un peu plissé; élytres terminés par une frange tomenteuse, transversées par une espèce de bande peu prononcée, un peu plus pâle que le fond, et ayant sur leur moitie anteriéure des points noirs élevés; dessous cendré, un peu mélangé de fauve."

Aurivillius, in the Junk Catalogue, places *Probatodes plumula* (Newman) as a synonym of *P. piliger* (Macleay). It is difficult to see how this error has occurred, for the species differ so widely that their identity is beyond dispute.

Newman's description of *Acanthocinus* ? *plumula* is as follows:

"Antennae corpore paullò longiores, basi sat proximæ, 10-articulatæ, articulo secundo sesquialtero, quinto apice plumoso, nigra, maculis elytrorum nonnullis, incertis, lanuginosus, canis. (Corp. long. ·475 unc. Elytrorum lat. max. ·2 unc.)

"Antennæ rather longer than the body, somewhat approximate at the base, the head being longitudinally grooved between them, 10-jointed; the first joint long and stout, the second less than half the length of the first, rather stout and apparently divided into two, but whether this division is apparent only or real, is a point on which, without attempting a separation, an observer is so liable to be mistaken that I will not venture to express an opinion; the third is long, slender and slightly arcuate; the fourth shorter; the fifth still shorter and bearing a small fascicle of black hairs on one side at its apex; the rest decrease in length; all the joints have a thin fringe of hairs on one side, they are black, with the exception of a small portion at the base of each, which is grey: the head and prothorax are black, with scattered grey hairs, the latter has a strong and sharp central tooth on each side, and three small obtuse tubercles on the base, the middle one of which is nearest the hind margin and unites with a small ridge which passes between the other two: the elytra are manifestly wider than the prothorax, and ample, extending beyond the abdomen; they are rounded at the apex, coarsely and deeply punctured, black, and variegated with irregular markings due to a short, velvety, grey pilosity, they have two short ridges at the base, one originating at the humeral angle, and the other halfway between that and the scutellum: the legs are moderate, the femora being decidedly, but not abruptly incrassated.

"*Hab.*—Van Diemen's Land: a single specimen in the cabinet of Mr. Westwood, to whom I am indebted for the opportunity of describing the species."

The more important and striking differences between the two species are:

Platyomopsis piliger: Thorax rounded and very indistinctly tuberculate at sides; elytra sparsely tuberculate, covered with a dense ashy-brown pubescence, with an indistinct chevron-like fascia about midway, apices fringed with grey hairs, strong humeral crests. Long 20 mm.

Probatodes plumula: Thorax with a stout and acute lateral spine, black with a scattered greyish pubescence; elytra deeply and coarsely punctate, the depressions with a sparse clothing of grey pubescence, no humeral crests. Long 13 mm.

The range of the two species appears to be:

Platyomopsis piliger: Queensland and New South Wales.

Probatodes plumula: Tasmania.

There is no doubt that *P. plumula* is a good species, and must accordingly be restored to the Australian list. Its synonymy is now:

Probatodes plumula (Newman).

(Plate iii, fig. 2.)

Acanthocinus ? plumula Newman, Zoolog., ix, 1851, App. p. cxxx.
Probatodes plumula Thomson, Syst. Ceramb., 1864, p. 57 .
Probatodes plumula Lacordaire, Gen. Coll. ix, 1872, p. 511.

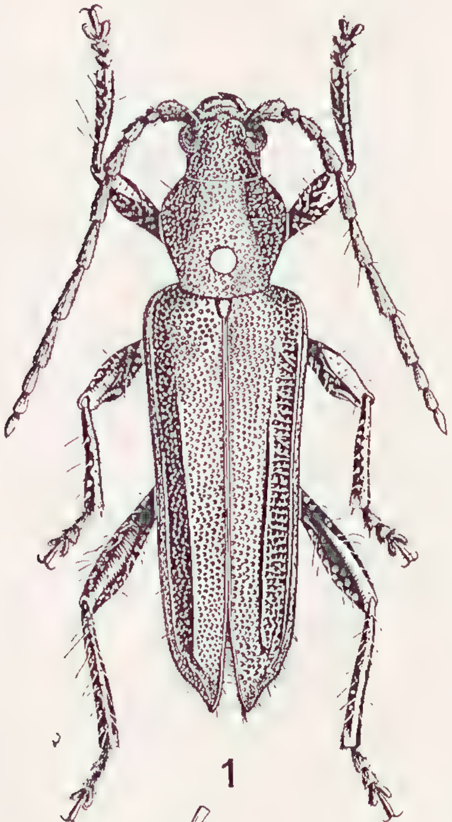
Genus Penthea Cast.

Penthea vermicularia (Donovan).

One damaged specimen, lacking one antenna and considerably abraded, in the Macleay Museum, labelled "*Lamia vermicularia* Don. Ins. N.H. tab. 6, Dej. Cat. *vermicularis*, New Holland, Captn. King".

EXPLANATION OF PLATE III.

Fig. 1.—*Pythcus erosus* (Macleay).
Fig. 2.—*Probatodes plumula* (Newman).
Fig. 3.—*Phacodes subfasciatus* Gahan.
Fig. 3*a*.—*Phacodes subfasciatus* Gahan (apices of elytra).
Fig. 4.—*Platyomopsis piliger* (Macleay).
Fig. 5.—*Hylotrupes bajulus* (Linnæus).
Fig. 6.—*Depsages solandri* (Fabricius).
Fig. 6*a*.—*Depsages solandri* (Fabricius) (apices of elytra).



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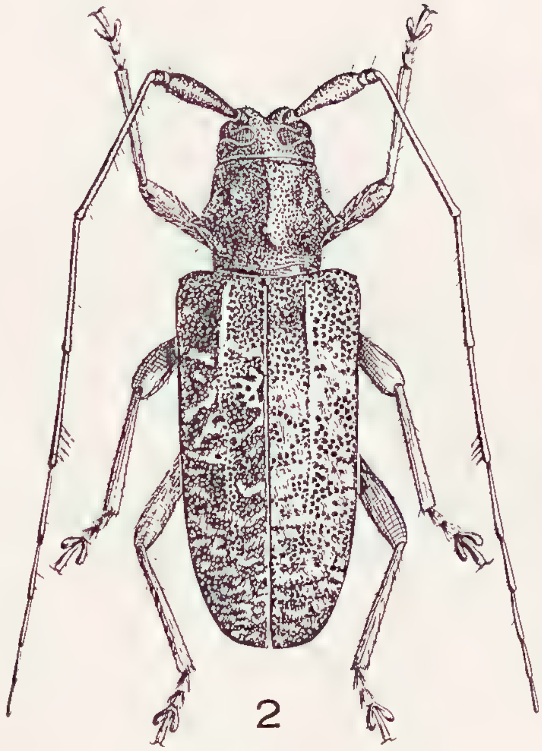

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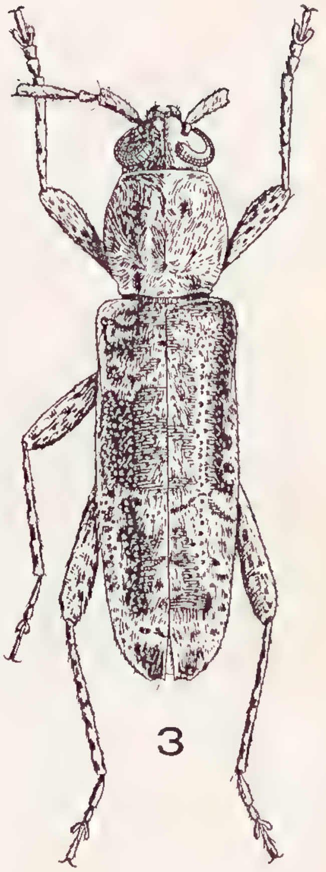

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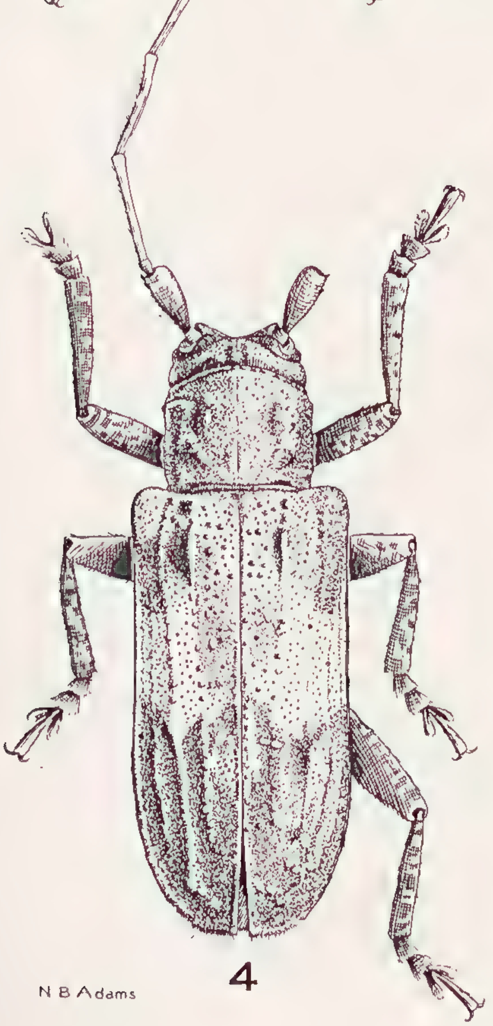

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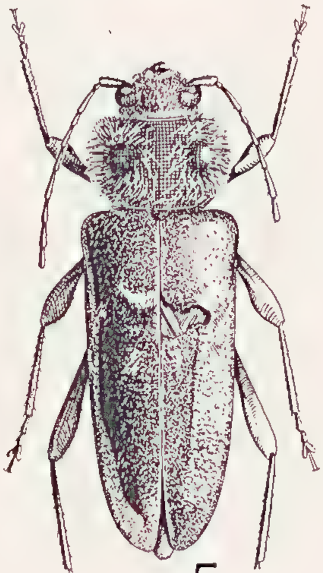

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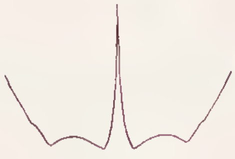

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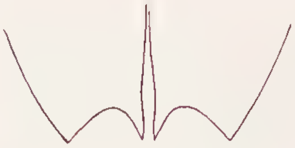
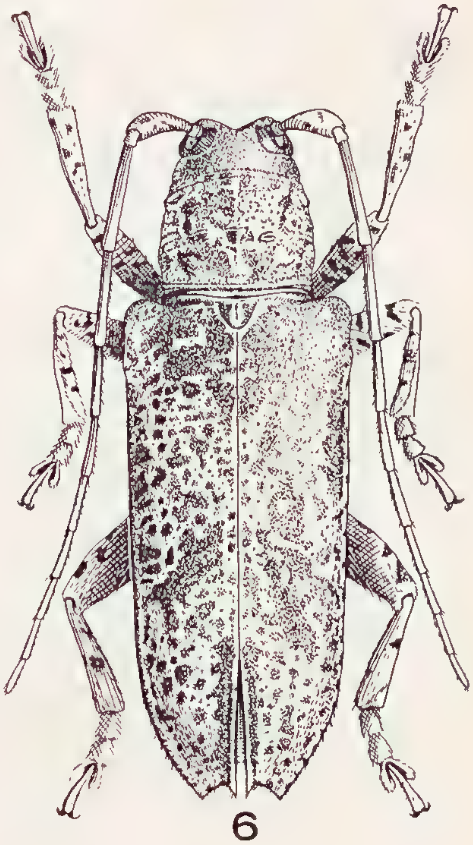


6 *a*



6

NATIONAL MUSEUM OF VICTORIA

NEW FOSSIL INSECT WINGS (PROTOHEMIPTERA, FAMILY MESOTITANIDÆ).

By

KEITH C. MCKEOWN,
Assistant Entomologist, The Australian Museum.

(Plates iv–vii, and Figures 1–3.)

THE present paper contains descriptions of a new genus and two species of fossil insects of the family Mesotitanidæ, Order Protohemiptera from the Middle Triassic beds of Beacon Hill, Brookvale, N. S. Wales. They occur in a lenticular mass of shale, about twenty-five feet in thickness, enclosed in the Hawkesbury Sandstone. From the same beds a large series of fishes has been obtained; these have been described by Dr. R. T. Wade.[1] I have also included notes on a fossil wing of *Mesotitan scullyi* Till., which is in a more complete state of preservation than the type specimen.

A few notes regarding *Clatrotitan andersoni*, sp. nov., and its discovery will be of interest. The fossil was collected by Mr. W. Bass, foreman of a brick quarry at Beacon Hill, Brookvale, near Manly, to whose interest this Museum has been indebted for many interesting specimens from time to time. From Mr. Bass the specimen was obtained by Dr. C. Anderson, Director of the Australian Museum.

The specimen is probably one of the most magnificent fossil insect wings in existence, on account of its large size, its beauty and the perfect state of its preservation. From this wing it is possible to estimate that the insect in life attained a wing-span of some twelve inches, but further reconstruction is impossible since we have no indication of the form of its body and appendages. In view of the perfect preservation of the single wing which remains to us, one cannot but regret that some portion, at least, of the body had not been included in the block of stone containing the specimen.

Although the Mesotitanidæ are provisionally included in the order Protohemiptera, doubt has been expressed in some quarters as to their actual affinities, and whether they can validly be considered to have Hemipterous characters. There is no doubt that a study of the venation, and especially of the remarkable "resonating area", should throw considerable light upon this problem.

Had the wing-tip only been preserved, it would have been possible to have prepared a reconstruction of the venation of the remainder on conventional lines, but such a reconstruction would have given not the slightest indication of the remarkable tympanum which occupies the basal two-thirds of the wing—a fact which emphasizes the danger of attempting such reconstructions from a small, and in many cases minute, fossil fragment.

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[1] Wade.—The Triassic Fishes of Brookvale, New South Wales. British Museum (Natural History), 1935.

Dr. R. J. Tillyard has suggested that the insect is probably the male of *Mesotitan scullyi*, but in view of the paucity of the fossil material of members of this family that has, as yet, been discovered, and our present knowledge, such a conclusion seems unwarranted, and it has been considered advisable to consider it as a new species, and to erect a new genus for its reception.

I desire to record my sincere thanks to Dr. C. Anderson, Director of the Australian Museum, for permitting me to describe this remarkable specimen, and for his ever willing assistance and advice. I wish, also, to acknowledge indebtedness to Dr. R. J. Tillyard for assistance in solving complexities of venation, Professor L. A. Cotton, University of Sydney, for the loan of material from the Geology Department of the University, Miss N. B. Adams for executing the drawings, the beauty and accuracy of which are a tribute to her patience and skill. To Messrs. H. G. Gooch, University of Sydney, and G. C. Clutton I am indebted for the fine photographs which illustrate this paper.

Family MESOTITANIDÆ Till.

Genus **Clatrotitan**, nov.

Insects of very large size: main venation of wings strong; cross-veins somewhat obliquely arranged in regular single rows. Subcosta and radius nearly parallel and close together. Rs six-branched, pectinate. M two-branched. Cu_1 four-branched, pectinate, Cu_2 nine-branched, pectinate. A large "grid" (probably a resonating area) consisting of three rows of more or less regular oblong cells, traversed by the two branches of M. Cubito-median Y-vein strongly developed. Wings pigmented.

This genus is proposed for the reception of *Clatrotitan andersoni*, sp. nov.

Clatrotitan andersoni, sp. nov.

(Plate iv and Plate v, figs. 1–3; text-figures 1–3.)

The type specimen is a forewing in an extremely fine state of preservation.

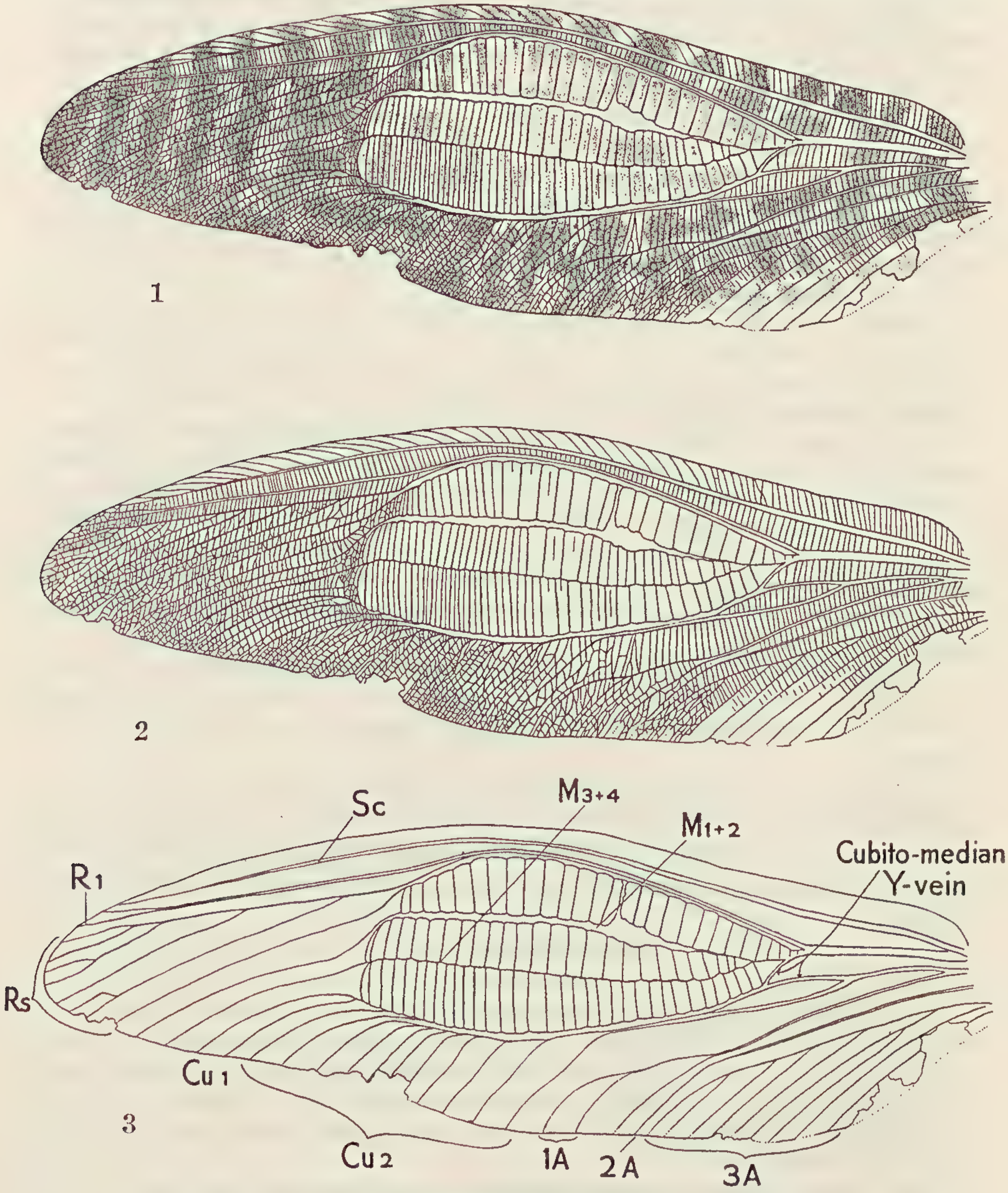
Total length of wing 138 mm., indicating a wing expanse of about twelve inches. Greatest breadth 44 mm.

Apex of wing somewhat obtusely pointed slightly nodding. Sc strongly concave, stout, with slender but clearly marked costal veinlets arising throughout its whole length; end of Sc about 15 mm. before apex of wing. R_1 strongly convex, as stout as Sc, running below and subparallel to it and ending just above apex. Rs slender, concave, unbranched until about two-thirds length of wing, when it gives off an obliquely descending pectinate series of fine veins. M with two branches only, *viz.*, M_{1+2} and M_{3+4}, running subparallel to one another and also to Rs above and Cu_1 below. M_{1+2} and M_{3+4} traverse the tympanum, and are unbranched throughout their length and strongly concave. MA is absent. Cubito-median Y-vein strongly developed. Cu_1 markedly convex and terminating in four drooping pectinate branches; it runs subparallel to, and a little above, the well-developed concave Cu_2, which has a strongly descending series of nine pectinate branches. 1A with one branch; 2A unbranched throughout its length; 3A with a pectinate series of descending branches, of which eight are visible (Figs. 1–3).

Archedictyon typical of the known Protohemiptera.

The "grid" or resonating area is a remarkable, somewhat irregularly lenticular area, 62 mm. long by 27 mm. broad, bounded by R_1 and Cu_1. The branches of

M, *viz.*, M_{1+2} and M_{3+4}, traverse this area, which is formed of three rows of oblong cells, 78 in number, of which 25 are in the upper, 21 in the median, and 32 in the lower row. The cells comprising the central row are, on the average, the widest, while those of the third are the narrowest of the series. Th average dimensions of the cells are as follows: Row 1, 7 mm. × 2 mm.; Row 2, 7 mm. × 2·4 mm.; Row 3, 7 mm. × 1·78 mm. Each cell is roughly oblong in shape, clearly and



Figs. 1-3.—Wing of *Clatrotitan andersoni*, sp. nov.
1. Pigmented areas, etc. 2. Venation. 3. Key to main venation.
N. B. Adams, *del.*

deeply defined on the lateral margins with a somewhat lunular area with a raised border, with an elevated hour-glass-shaped area in the centre; ends of cells rounded. The structure of the "grid" and its component cells is splendidly shown in Plate iv, fig. 1, so that further detailed description is unnecessary.

Pigmentation is present. Seventeen clearly defined dark blotches on costal area; apex of wing heavily clouded with dark pigment, with a few irregular light areas. Toward base, and especially on anal region, the pigmented patches become sparse and irregular. Some indications of pigmentation are present on the "grid", particularly on the upper row of cells, but are very indistinct. On some sections of the wing the dark areas tend to form irregular fasciæ.

It appears probable, from the study of the tympana of recent insects, that the grid-like structure of the wing is a resonating area, and it may, therefore, be presumed that the wing is from a male example of the species. Nothing that could be regarded as stridulating apparatus is distinguishable on the wing, and, in the absence of the body of the insect, it is not apparent how any sound could have been produced, but it may be surmised from the large area of the tympanum that it must have been considerable.

Further material has been available for study in a complete wing in a very bad state of preservation, both original (obverse) and counterpart being badly shattered, and each is traversed by numerous fractures. Both specimens are in the Geology Department of the University of Sydney.

Total length of wing 118 mm., indicating a wing expanse of about 9½ inches. Greatest width 40 mm. A smaller specimen than the type. Fourteen cells of the upper row of the "grid" are wholly or partially preserved; only one cell and indications of a second remain of the second row; the third row entirely destroyed. Costal area and apex of wing in a fair state of preservation. Section of anal area present showing a small portion only of the anal venation. The greater part of Sc and R_1 preserved, together with the basal portions of M and Cu, and the basal portions of Cu_2 and 3A.

Pigmentation present, there being seven squarish patches on the costal area; apex clouded with dark pigment with indications of irregular wavy light bands.

The species is dedicated to Dr. C. Anderson, Director of the Australian Museum, Sydney.

Holotype: Australian Museum, Sydney (F 36274). Middle Triassic, Beacon Hill, Brookvale, near Manly, New South Wales (W. Bass).

Paratypes: Paratype $\binom{I}{1}$ and paratype counterpart $\binom{I}{2}$, Beacon Hill, Brookvale, near Manly, N.S.W., Geology Department, University of Sydney, Sydney.

Mesotitan tillyardi, sp. nov.

(Plate vi, fig. 2.)

Total length of wing preserved 87 mm., indicating a full wing-length of at least 145 mm., and an expanse of wing of about 12 inches. Greatest width 36 mm.

Base and apex of wing wanting. The preserved portion of the wing consists of the central portion, equalling about half the total area. The greater part of the anal area is wanting, together with the posterior marginal area, which is badly broken and crumpled.

Sc markedly concave, very strongly developed, with slender but clearly marked costal veinlets arising along its whole length, slanting very obliquely toward apex. R_1 markedly convex, almost, but not quite, as stout as Sc, running below and subparallel to it. Rs a slender concave vein, unbranched for 51 mm. from its origin, when it gives off an obliquely descending vein, R_{4+5}; the other branches from Rs have been destroyed. M dividing into two branches only, both of which are concave, and there is no MA present. M_{1+2} runs subparallel to M_{3+4}. Both veins curve somewhat sharply downward, causing them to run parallel to each other and to the first branch of Rs, *viz.*, R_{4+5}. Cu_1 not very strongly developed, but markedly convex, running subparallel to and a little above Cu_2. Portion preserved unbranched. A short section only, 17 mm. in length, of Cu_2 is present; no trace of branching remains in the specimen. A section only, 14 mm. in length, remains intact of 1A and 2A. 1A convex, 2A concave.

Archedictyon typical of the Mesotitanidæ, but transverse veins much coarser and more prominent than on other species.

Pigmentation present, the wing being irregularly mottled and blotched with alternating areas of dark pigment with light areas intervening; these dark areas are squarish, tending to form irregular and broken transverse fasciæ. Some ten such fasciæ can be made out crossing the wing from the costal margin on the part preserved. Patches of dark pigment most distinct on costal area; elsewhere poorly defined.

The cell formation in the area between Rs and Cu_1 is large and well defined, the dividing veinlets being very marked and strongly defined, and might almost be described as an incipient "grid", or at least as indicating the primitive type of cell structure giving rise to the "grid" or resonating area so strongly developed in *Clatrotitan andersoni.* A very interesting specimen forming, perhaps, a transitional stage intermediate between *Clatrotitan* and *Mesotitan*, but until further material is forthcoming may be left in the latter genus.

Holotype: Holotype specimen (GD), Beacon Hill, Brookvale, near Manly, New South Wales; in Coll. Geology Department, University of Sydney, Sydney.

This species is dedicated to Dr. R. J. Tillyard, whose work has greatly advanced our knowledge of the fossil insects of Australia.

Mesotitan scullyi Tillyard, 1925.[2]

(Plate vi, fig. 1; Plate vii.)

A further specimen of this species was included in the material studied during the preparation of this paper, and has been compared with the type wing fragment. Since this specimen is more complete than the type, it is considered advisable to give an account of it here.

Total length of wing preserved 131 mm., indicating a full wing length of at least 145 mm., and an expanse of wing of about 12 inches. Greatest width 34·5 mm.

Extreme apex of wing wanting. The preserved portion of the wing consists of the proximal nine-tenths; the anal area is wanting, together with portion of the posterior margin, which is somewhat badly crumpled.

Sc markedly concave, very strongly developed, with many slender but clearly marked costal veinlets arising along its whole length, erect on basal third of wing; slanting very obliquely toward apex on distal two-thirds. R_1 markedly convex, but quite as stout as Sc, running below and subparallel to it. Rs is a slender concave vein diverging from R_1 33·75 mm. from base of wing and continuing unbranched for 54·5 mm., when it gives off an obliquely descending pectinate series of two veins, the first being R_{4+5}, the second R_2. It would appear probable, on the analogy of the type wing-tip of *Mesotitan scullyi*, that there are a third and fourth short terminal branches from R_2. M diverges 37 mm. from base of wing into two branches only, M_{1+2} and M_{3+4}. Both these branches are concave and there is no MA present. M_{1+2} runs subparallel to M_{3+4}, also to Rs and R_{4+5} above and Cu below for about 51·5 mm., when it dips sharply toward M_{3+4} and then rises again toward the apical portion of the wing. Cu_1 not very strongly developed, but markedly convex, running subparallel to and a little above Cu_2, and forking distinctly in a descending branch at a point about two-thirds its length. Cu_2 well developed, concave, with a descending pectinate series of branches, of which five can be distinguished. Three anal veins can be distinguished, but the whole of the anal area is much crumpled and broken.

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[2] Tillyard.—Proc. Linn. Soc. N. S. Wales, l, 1925, pp. 374-377.

Archedictyon typical of the Mesotitanidæ.

Pigmentation present, the wing being irregularly mottled with areas of dark pigment alternating with light blotches; these dark areas are squarish in shape, tending to form very irregular and broken transverse fasciæ; some ten such fasciæ can be made out crossing the lighter parts of the wing from the costal margin on one portion preserved. The fasciæ are darker and more regular towards the base.

This specimen (Plate vi, fig. 1) is preserved in the Collection of the Geology Department, University of Sydney, Sydney. $\frac{\text{US}}{\text{GD}}$ 310, Beacon Hill, Brookvale, near Manly, New South Wales.

In order to make as much information as possible available to workers on our fossil insects of the family Mesotitanidæ, I reproduce herewith (Plate vii) a photograph of an almost complete forewing, together with portion of another ? hind-) wing below. The specimen represented in the photograph was, it is understood, in the possession of the Geology Department of the University of Sydney, but its present location, at the time of writing, is unknown; it has therefore been impossible to examine it.

The basal third of the large wing has been broken and forced downward from the costal margin with consequent crumpling, especially of the anal area, and portion of the branching of Cu_2.

The second wing consists of approximately the posterior half of the wing; the section between the costa and the main stem of Cu_2 is in a good state of preservation. Then venation is similar to that of the large wing.

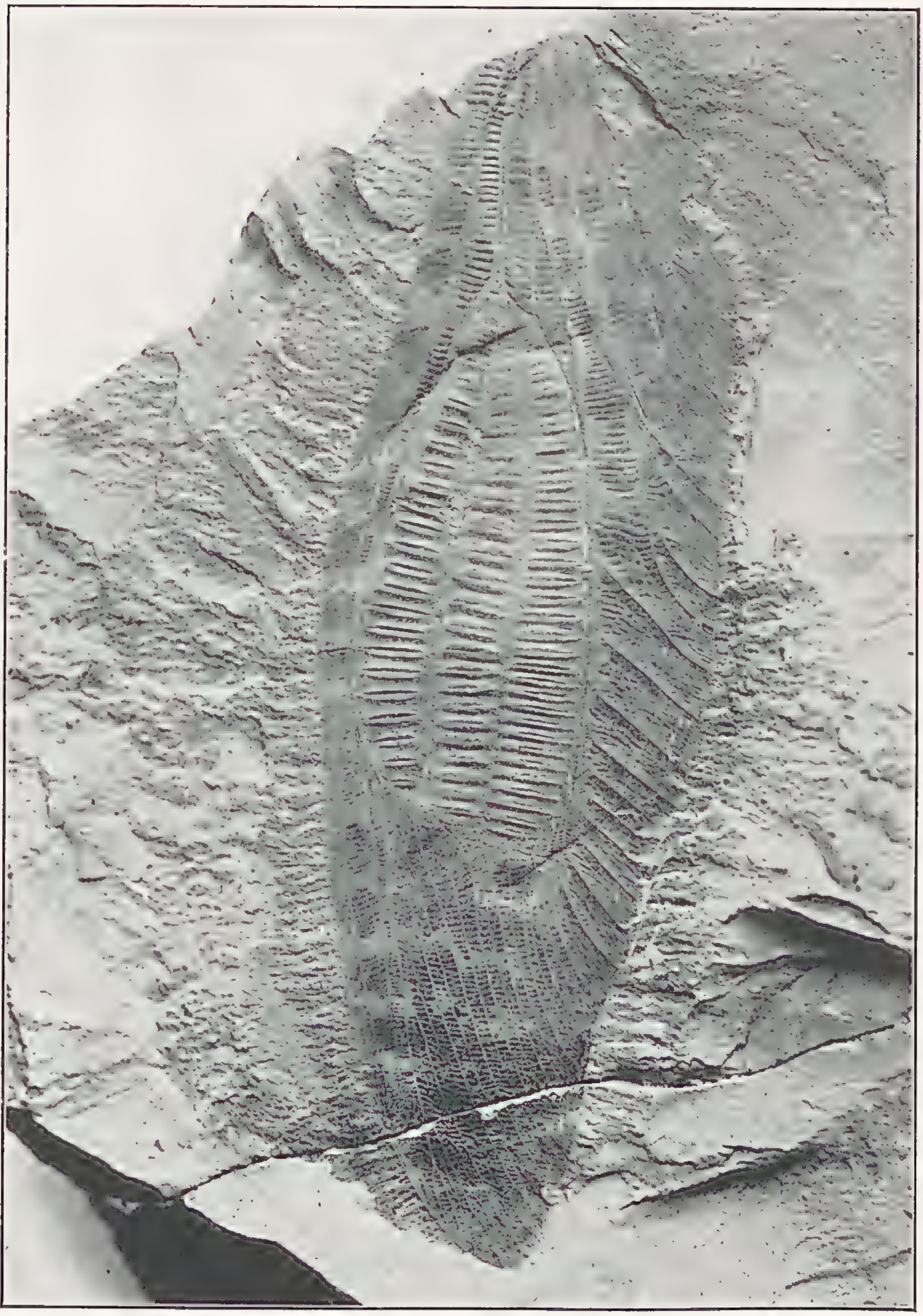
Rs has its origin very close to the base of the wing, about 6/7 of the distance from the apex. The forking of M is also very clearly shown. Cu_1 unbranched. Portion of Cu_2 is preserved, and shows indications of five pectinate branches. Sections of two anal veins (unbranched) remain, but almost the whole of the anal area and the posterior branches of Cu_2 are buckled and destroyed.

Apex of the wing is strongly pointed, slightly nodding.

Details are well shown in the photograph.

It is impossible in the absence of the specimen to state the dimensions, but the breadth of each wing is about ¼ of its total length.

The wings appear to be identical with those of *Mesotitan scullyi* Till. As far as I can ascertain, the specimen was secured, like the others, at Beacon Hill, Brookvale, N. S. Wales.



G. C. CLUTTON, photo.

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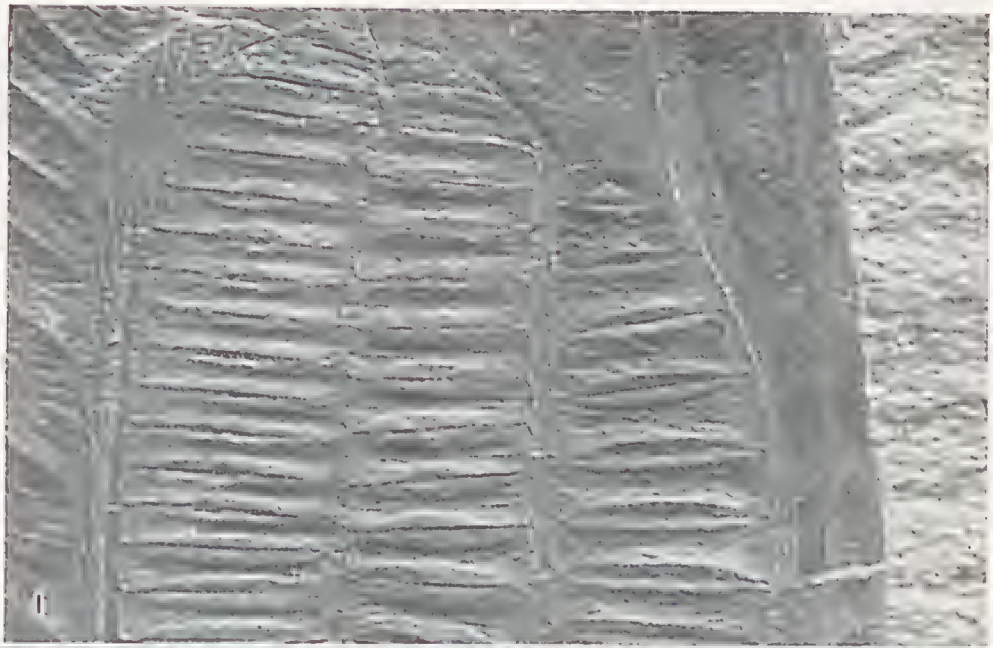

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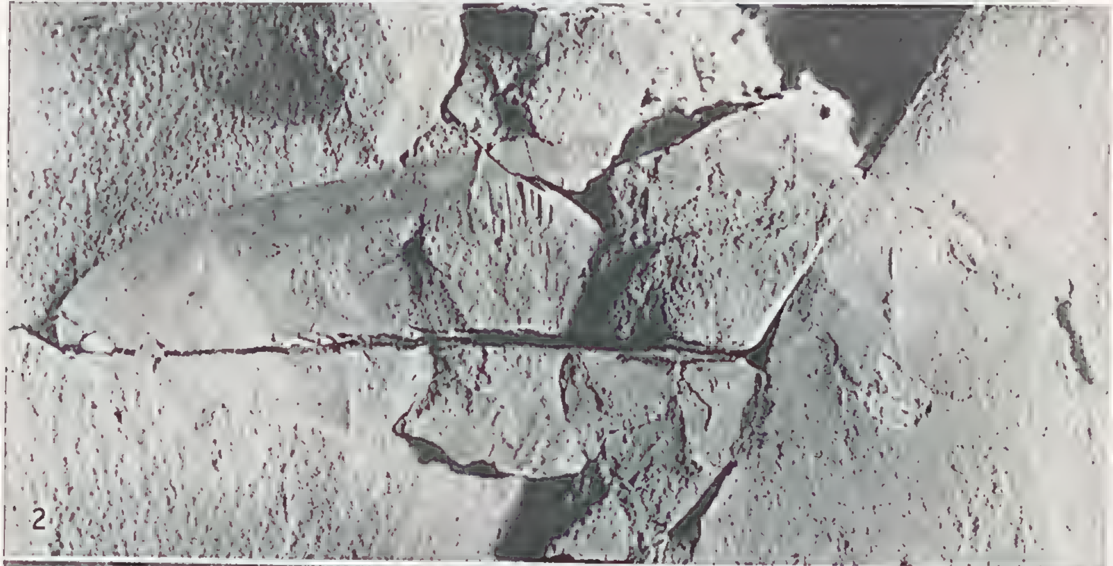

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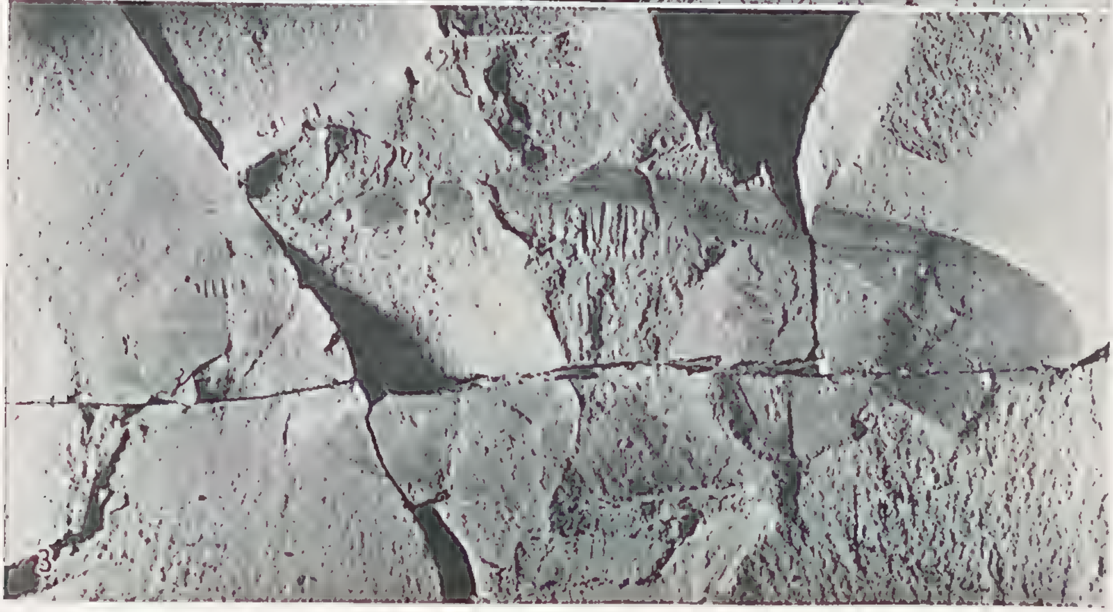

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G. C. Clutton, photo.

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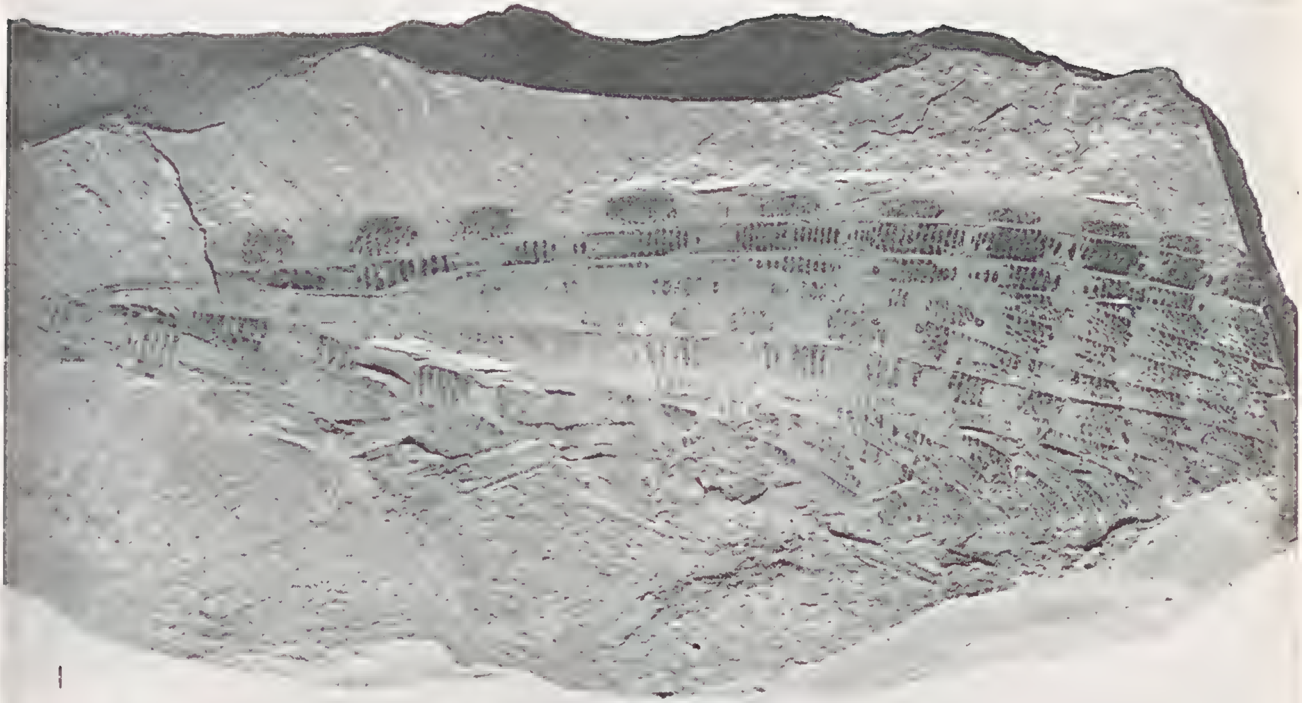

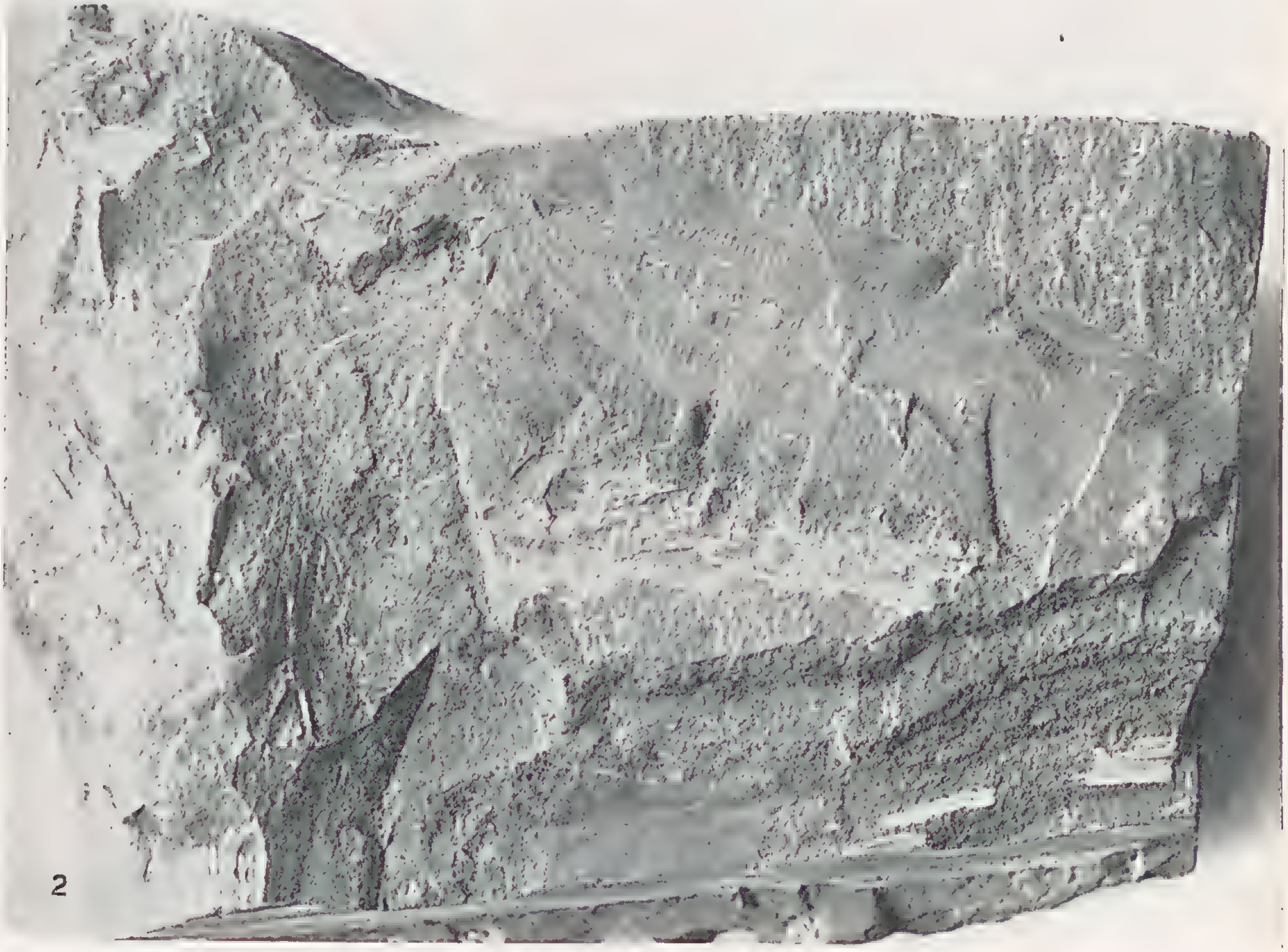

H. G. GOOCH (1), photo.
G. C. CLUTTON (2), photo.

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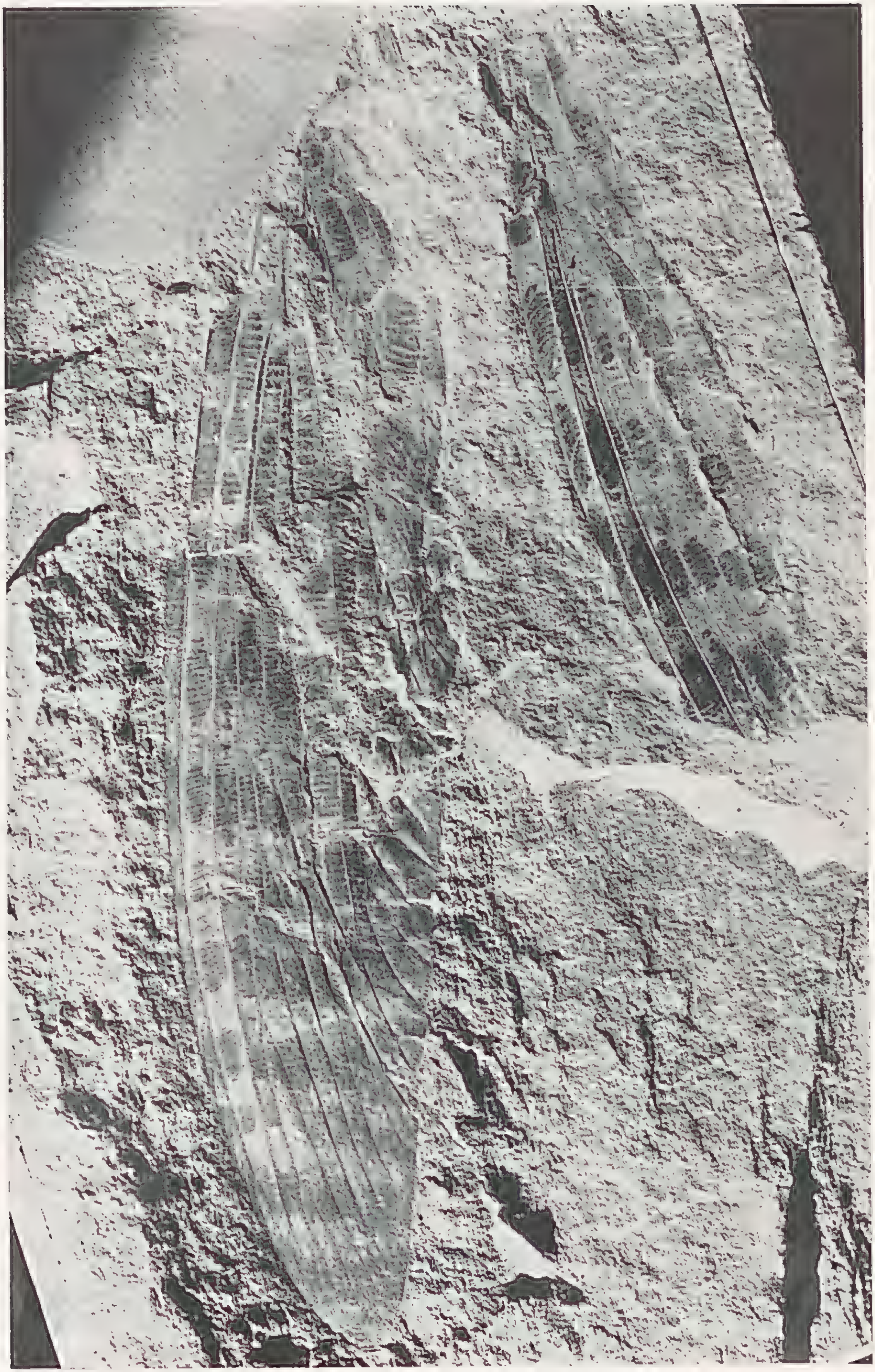

H. G. Gooch, photo.

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EXPLANATION OF PLATES.

PLATE IV.

Photograph of type of *Clatrotitan andersoni,* sp. nov. Beacon Hill, Brookvale, New South Wales.

PLATE V.

Fig. 1.—Portion of resonating area of wing of *Clatrotitan andersoni,* sp. nov. (type) (greatly enlarged).

Fig. 2.—Paratype counterpart of *Clatrotitan andersoni,* sp. nov. Beacon Hill, Brookvale, New South Wales.

Fig. 3.—Paratype of *Clatrotitan andersoni,* sp. nov. Beacon Hill, Brookvale, New South Wales.

PLATE VI.

Fig. 1.—Wing of *Mesotitan scullyi Tillyard.* Brookvale, New South Wales.

Fig. 2.—Wing of *Mesotitan tillyardi,* sp. nov. (type). Beacon Hill, Brookvale, New South Wales.

PLATE VII.

Wings of *Mesotitan scullyi* Tillyard. ? Brookvale, New South Wales.

THE FOOD OF TROUT IN NEW SOUTH WALES. 1935-1936.

By

Keith C. McKeown,
Assistant Entomologist, The Australian Museum.

The accompanying paper embodies the results of the investigation into the food of trout in New South Wales carried out during the season 1935-1936, and gives details of the stomach contents of 108 Rainbow Trout (*Salmo irideus* Gibbons) and 72 Brown Trout (*Salmo fario* Linnæus).

The information obtained in the course of the season's work forms a valuable addition to our knowledge of the varied forms of life which constitute the diet of the fish in those inland waters from which it was possible to obtain material for examination. Members of the Rod Fishers' Society of New South Wales again ably assisted in securing and submitting stomachs from the fish caught, and by their encouragement and co-operation have rendered the investigation possible. It is, however, somewhat disappointing that so few streams are represented, in spite of repeated requests for material from new localities, especially as the information which could have been obtained from such sources would have been of undoubted value in estimating the relative suitability of these waters for future liberation of fry. The information which has been obtained, however, has served to widen considerably our knowledge of certain rivers, and has, in some cases, filled lacunæ in our records, rendering possible the compilation of very complete data for some districts. It is owing to the enthusiasm of Dr. A. J. Spiller Brandon that our information regarding the Tuross River, with reference to both Brown and Rainbow Trout, is very satisfactory, and forms a valuable basis for further work, especially should it be considered necessary to make a detailed survey of the aquatic and terrestrial life of the stream. Such a survey, carried out in full detail on one river, would prove of undoubted scientific interest and value.

Owing to the kindness of Dr. A. J. Spiller Brandon, I was enabled to accompany him to the Tuross River in January, where, as his guest, I was able to carry out work in the field, which, in spite of the short time available, has been valuable in elucidating certain problems that had developed in the course of the laboratory work to which the investigation had previously been confined. This field work will be referred to in greater detail below, together with certain tentative recommendations arising from my observations.

Notes on Food.

The presence of fish fry in four stomachs of Rainbow Trout from the McLaughlin River is of considerable interest in connection with the contention of many anglers that the adult fish are responsible for the destruction of many trout fry. Seventy-seven fry were obtained, all in an advanced state of digestion, and, although specific identification was impossible, Mr. G. P. Whitley, Ichthyologist, of the Australian Museum, was able to give me an assurance that the fish were not trout, and that of this he had no doubt. It is possible that the young fish were a species of gudgeon, popularly known as "Mountain Trout", which would form a very fine food for the trout.

Fish remains have occurred only in one other instance, where the bones of a small cat-fish were recovered.

Fish from the McLaughlin River also contained very large numbers of the larvæ of a Stratiomyiid fly which had previously occurred only sporadically. Many Bombyliid larvæ were also present. The small Dytiscid beetle, *Necterosoma penicillata*, apparently abounds in the McLaughlin, since of a total of 1,377 Coleoptera recovered, the majority proved to be of this species.

The total of 1,256 caddis cases from one stomach from the Kybean River constitutes a record for the number of these insects recovered from any one fish in the course of the investigation, and is concrete evidence of the abundance of these insects which must be present in this river, forming a rich feeding ground for the trout.

The majority of the stomachs examined revealed little in the nature of food that has not been previously recorded in the course of the investigation.

Economic Value of the Investigation.

The realization of the economic value of the investigation of the food of trout still makes slow progress against the generally preconceived opinion that such research has but a purely academic interest, with the result that its practical application tends to become lost sight of and obscured. Such an investigation requires to be translated into terms of cash value before public interest and support are assured.

Dr. R. J. Tillyard has ably stated the position in a recent paper.[1] He says: "The study of the more important insects which serve as food for trout in any given country is, in these days of applied science, an indispensable preliminary to a full understanding of the methods by which a successful and permanent trout-fishery can be maintained in that country. For many years I have been interested in those groups of aquatic insects which are of most importance as trout-food. But I have never found, anywhere in Australia, any public realisation of their economic importance, and thus it comes about that, even to-day, when scientific ideas have penetrated further into the public mind than ever before, it still remains impossible for any work on such insects to be carried out officially. The alternatives are, either to leave the subject alone and let the knowledge gained die with one, or to work at the subject slowly in one's spare time in the hope that something of value may come out of it in time to save the inland fisheries of Australia from deterioration due to lack of scientific knowledge.

"It is my considered opinion that the time has now come when it is imperative that a scientific survey of the trout-food insects should be carried out in all the principal trout-fishing districts of the Commonwealth. These are to be found in New South Wales, Federal Capital Territory, Victoria, and Tasmania. From a faunal point of view, the first three are closely united, and might well be studied as a faunal unit, though the number and variety of the streams included would make a thorough survey a lengthy and difficult task. Tasmania, however, needs to be studied separately, not only because it is an island, possessing marked peculiarities in its aquatic fauna, but also because in Tasmania alone, of any part of the Commonwealth, there are present fresh-water lakes suitable for trout-fishing and, in many ways, superior to the rivers."

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[1] The Trout-food Insects of Tasmania. Part I—A Study of the Genotype of the Mayfly Genus Atalophlebia and its Life History. *Paps. and Procs. Roy. Soc. Tas.*, 1933 (1934), pp. 1-16, pls. i-ii.

In the present investigation it has been possible to carry out the work and publish the results under the official ægis of the Australian Museum, and with the co-operation of the New South Wales Rod Fishers' Society, but there is still much prejudice and misconception to be overcome.

There is no doubt that a thorough knowledge of the conditions existing in the various trout streams is essential for the development of trout-fishing in Australia, and the placing of the question of further stocking upon a sound scientific basis. Waste of money only can result where fish are introduced into streams where the existing conditions are obviously unsatisfactory, or where the profitable carrying capacity of a river is, or will be, exceeded. It is to be hoped that the question of a detailed scientific survey of the trout-food insects of Australia may be undertaken in the future, and the results co-ordinated by the newly-formed Federal Association. The systematic collection of trout-food insects from the Tasmanian lakes has already been undertaken by Mr. Critchley Parker, of Melbourne, and the necessary work of research is being carried out by Mr. Martin E. Mosely, of the British Museum (Natural History).

Stream Reports.

The following reports of stream conditions, based upon notes published in the *New South Wales Rod Fishers' Society's Gazette*, are of value in considering the results obtained from the examination of the stomach contents, since they record the conditions existing at the time of the capture of the fish.

Kybean River.

Mr. F. W. Barrett visited the Kybean River, which at the time was covered with weeds, encroaching almost to the middle of the stream; however, he was successful in obtaining some good fish, his best being 4¾ lb.; others taken weighed 3½ lb. and 2 lb., the smallest being 1½ lb.

McLaughlin River.

Mr. F. W. Barrett visited the McLaughlin River, and here again the weed (known as "Frogs' Blanket") was a disadvantage, the fish making good use of it when hooked. He experienced some good fishing there, his largest fish being 3½ lb., and he caught several others near that weight. Mr. W. J. Forbes also visited the river, and once more weather conditions were not conducive to good fishing. On this river the fish are, as a rule, very large, averaging just under 3 lb. During this visit, the river was fairly well covered with the "Frogs' Blanket" weed. Dr. Archibald Glen reported that the fishing in the McLaughlin was not as good this season as previously, owing to bad weather conditions; but the type of fish to be got from this stream are well worth persevering for, being large and numerous.

Badja River.

Mr. A. C. Ebsworth paid a short visit to the Badja River during October, and encountered bad weather; it was raining when he arrived, and wet weather continued, with the result that the river rose about four feet above its usual level, and was running like a mill race; consequently he did not get many fish. A succession of floods had removed most of the weed, with the result that the fish were not in the spots where one was accustomed to find them in past years. The weed, however, is beginning to grow again, and within the next year or two the fishing should be good. About a week after his arrival, when the weather had abated, it was quite a revelation to find one evening an enormous rise of fish; this was very encouraging, for these large numbers of fish, from ¾ to 1½ lb. in weight, indicate that in another year or so the fishing on this river should be very good.

Barrington River.

Mr. G. H. Montgomery spent a week or two on the Barrington River. The weather was not good, and on the whole his trip was not successful. Dr. C. Anderson reported the fishing as generally unsatisfactory. This river is a small stream with some big holes here and there.

Gungarlin River.

Mr. R. J. Jenner visited the Gungarlin River on two occasions during the season. This stream has its source between Kiandra and Adaminaby, about 6,000 feet above sea-level, and winds downwards through the Snowy Plains to the Snowy River. In December the fish were numerous, and one could say that this stream is the breeding ground for the Snowy and other rivers connected with it. The fish averaged two pounds.

Fish River.

Mr. W. J. Forbes visited Oberon at the beginning of the season, but weather conditions were unsatisfactory and the fish were not moving. Mr. Wm. Smith was at Oberon in October, but only caught a few fish. He was there again for Christmas, when the river was very low and clear, and the fish could be seen moving about, but results were not satisfactory.

Duckmaloi River.

At the opening of the season, Mr. Maurice Brown visited "Trout Park" on the Duckmaloi River, where he found that the fishing was not good, and he only caught enough for the camp. He went there again during the season, with the same result.

Tuross River.

Dr. A. J. Spiller Brandon reported that his experiences of the past season were varied, and that reports which had come to hand, not only from this State but Victoria, were to the effect that the season just closed was below the usual standard. He said it was very hard to explain this. Conjecture only is possible, but we know that it has been a very extraordinary season, with cold weather and high winds, interspersed with hot days; and nothing seems to upset trout more than sudden changes. Particularly dry weather was experienced, and possibly this had a quietening effect on the fish in regard to their feeding habits, and may have also affected the various insects, etc., on which the trout live.

During the first week in October, Dr. Brandon visited the Tuross River mainly for the purpose of releasing the fry which had hatched in the Society's Hatching Box in the river. He was there for 24 hours, and after attending to the box, he walked along to examine the stream, and found it very low and the fish very plentiful. It was interesting to note that they were feeding upon the bottom, and could be seen where there was no weed, nosing in the sand and suddenly darting at something which they had disturbed—probably shrimps or larvæ. Fishing was hopeless, as one could put a fly down over their noses and they were not at all interested.

At the end of October conditions were considerably better, but at the same time the fishing was not so good as in previous years. Again sudden changes were experienced, which apparently had their effect upon the fish.

He visited this stream again in December, when he found the fishing much better, and, in comparison with the previous visit, interesting. During the previous season the Christmas beetle (*Anoplognathus*) was much in evidence on the river gums overhanging the stream, and it was only a matter of going under these gums to find the fish waiting for the beetles to fall into the water; but this season the Christmas beetle did not live up to its name, and it was not until after Christmas that it made its appearance, and then seemed to avoid all gums on the river bank, but was plentiful on gum trees elsewhere, with the result that, whereas during the previous year large numbers of fish were caught under these gum trees, this year he only caught one throughout the whole season.

Towards the end of January hot weather was experienced, and conditions became more settled. The river being rather low, the fishing became extremely bad. It is very hard to give a reason; there was certainly plenty of insect life on the water, but the surface of the water was definitely warm, which no doubt kept the fish on the bottom. These conditions continued until a cold change was experienced, with rain and a fresh in the river, when the fishing became decidedly better, but towards the middle of February there was a continuous emergence of the little black ant or a Chironomid midge, and a light breeze was blowing them onto the water. Big fish were coming to the surface, and it was most exasperating to sit on the bank and watch them (they were not frightened) having a continuous feast from daylight until dark. What the fish saw in this tiny ant it is hard to say, but it was evidently something very attractive. Dr. Brandon had in his box some of the so-called "black ants", which are supposed to imitate the black ant; he put one on the water amongst the multitude of insects, but his small imitation looked like an elephant compared to the live insect, and the gut looked like a piece of rope. The fish took no notice of the fly. These conditions persisted for about a fortnight, and, in exasperation, he eventually avoided this particular pool. He is of the opinion that when the trout are rising like this, it is a fluke if you catch one. The Brown Trout, although plentiful in the river, were noted as being absent from those waters where the ants were numerous. The fishing from day to day after this was better, and it was possible to obtain a few nice fish if one persevered.

Field Notes on the Tuross River.

During a visit to the Tuross River as the guest of Dr. A. J. Spiller Brandon, between the 15th and 22nd January, 1936, the writer had an opportunity of making a preliminary survey of the stream conditions. Owing to heavy rains flooding the river during the first few days of my visit, it was not possible to carry out much work on the aquatic insects and other stream-bed population, but work on these was carried out towards the end of my stay.

For the preliminary work the Tuross River was conveniently divided into three main types: (1) Stream with thick fringing growth of tea-tree and other flowering bushes which overhang the water, (2) more open country with tall river gums, as at "Nosey Bobs", and (3) stream confined between rocky banks and with sparse vegetation. At the time of my visit the tea-tree was in full blossom, and abounded with flower-haunting insects, *Phyllotocus* spp., Elateridæ, Thynnid wasps, etc., which, falling from the bushes into the water beneath, provided a constant supply of food for the fish. That the fish availed themselves of this insect food is amply borne out by the contents of the stomachs examined. The river gums on the more open stretches carried a heavy population of *Anoplognathus*, Cerambycidæ, etc. In the case of the *Anoplognathus*, pairing was in progress, and the insects frequently lost their footing in the foliage and fell into the river below, where it was seldom that they struggled for long before being taken by trout. These beetles, if thrown upon the water, were always readily taken by the fish, and formed a useful indication of their presence in any particular reach of water, and there is no doubt that during their season the beetles form an important item of trout-food; they have the advantage of being of large size, and, during the early part of the season, the bodies of the females contain considerable nutriment in the developing ova; later the gravid females are crammed with eggs in an advanced state of development and of large size. Those portions of the stream which are hemmed in by rocky banks carry a smaller population of terrestrial insect fauna, but are undoubtedly, under normal conditions, rich in aquatic species.

The examination of the insect population of the stream itself revealed a general scarcity of aquatic forms. This, I believe, is mainly due to the fact that repeated flooding last year has tended to scour the river clean of weed growth. Here and there the weed is beginning to re-establish itself, and it is in such places that the aquatic insects are numerous. The basis of these gatherings of insects is the phytophagus species, with the consequent attendance of the carnivorous insects which prey upon them, and, attracted by their presence, occur in considerable numbers. The dominant insect form in these weedy areas is the caddis, while the predatory insects are largely represented by a number of species of Odonata, *Corixa*, *Notonecta*, etc. Mayfly nymphs were reasonably plentiful where abundant vegetable matter was present, as in some of the open pools, or where branches and trunks of trees have fallen into the stream; the latter situations are especially important.

Few caddis were present on the gravelly bottoms, and were only a little more numerous on the sandy areas. With the exception of the weedy areas, previously mentioned, caddis were generally very scarce throughout the area of the stream investigated, and their absence is strikingly borne out by the examination of the stomach contents. In previous years extremely large numbers of caddis cases were obtained from trout stomachs, and it was unusual to find examples which did not contain, at least, some of these insects. In this season's work it has been exceptional to find stomachs which contained even a moderate number, and in very many cases they have been completely absent.

The majority of the Odonata, which were numerous along the stream, were breeding extensively in nearby marshy areas. The dragonflies cling in large numbers to the sedge and bushes at the river's edge, and in dull misty weather are in semi-torpid condition and may be picked from their resting places with the fingers—the use of a net being unnecessary. While in this torpid condition many of the insects fall into the water, and become a prey to the fish. Sometimes, however, large numbers of adults of the stream-breeding species are taken by the fish when they descend the stems of the water-weeds in the course of ovipositing, on which occasions the sexes are completely submerged, *i.e.*, the Zygopterid forms.

Notes and Recommendations.

From the work carried out on the Tuross River in 1936 and the investigation of the stomach contents of the trout from a number of streams in New South Wales each season since 1931, the following notes may have some value in assessing the value of trout streams, selecting further waters for the liberation of fry, and the possible improvement of streams of poor quality, or where deterioration has taken, or is taking, place. Such suggestions are tentative only, and further work is required before definite recommendations can be made.

Weeds.

Although generally disliked by the angler, there is no doubt that the growth of aquatic vegetation in the rivers is conducive to a plentiful supply of food for the fish in all stages, and possibly forms one of the most satisfactory breeding-places for the aquatic forms of life which form such an important item in the food of trout. The effect of weed growth upon the animal population of the streams is very conclusively borne out in the case of the Tuross River. Here we find caddis-worms occupying a very important position in the food of the fish until 1935, when heavy and repeated floods cleared the weed-growth from the stream beds, with the result that the numbers of these insects fell to relatively small proportions. A field examination of the river disclosed that only where weeds were present were the insects at all numerous in 1936. A condition of affairs similar to that obtaining in the Tuross seems to exist on the Badja. In each case fishing is reported as not being as satisfactory as in previous years. The McLaughlin and Kybean Rivers are reported as being covered very thickly with weed ("Frog's Blanket"), and here the proportion of aquatic insects—especially caddis—is extremely high, and the fish from these streams seem to be of good quality and of a consistently high weight.

Vegetation on Stream Banks.

Vegetation growing on the stream banks, especially tea-tree and other flowering shrubs, forms a valuable attraction for foliage-feeding and flower-haunting terrestrial insects, and large numbers of these insects drop from the foliage of the shrubs into the water beneath, where they are consumed by the fish. A very large proportion of the food of trout in Australia consists of such terrestrial forms of life. Such vegetation should, therefore, be strictly preserved, and its destruction should not be permitted under any circumstances. It is noted (*N.S.W. Rod Fishers' Society's Gazette*, iii, January, 1935, p. 4) that Mr. Church, in referring to the Duckmaloi River, states: "Over nine miles of river frontage, including some four miles of Bindo Creek (a happy hunting ground for rainbows), Mr. Porter has cleared a track right round this, removing tea-tree scrub in many places, and is actively engaged in fostering the gentle art of fly fishing . . . these nine miles almost represent a fish sanctuary, and are rapidly becoming stocked with excellent sized fish, both Rainbow and Brown." It is perhaps significant to find the following report in a later issue of the same journal (iv, June, 1936, p. 9): "Mr. Maurice Brown had several trips during the season; and at the opening visited 'Trout Park' on the Duckmaloi River, where he found the fishing not much good; it is beautiful water, and he caught about enough for the camp. He went there again during the season with the same result." A very large proportion of the food of trout from the Duckmaloi River was made up of terrestrial insects, but unfortunately no material was secured from that stream during the present season, when the information would have been especially valuable.

The question of planting native shrubs, such as tea-tree, along the banks of streams, where these are lacking in suitable vegetation, as in the lower reaches of the Fish River, might be worthy of some consideration and investigation.

Submerged Logs and Branches.

Where logs and branches lie submerged in the streams, they unquestionably form a highly favourable breeding ground for Mayfly nymphs, and consequently are valuable in augmenting the supply of food available for the fish. Where practicable, such logs and branches might well be sunk in suitable situations where they are unlikely to interfere with the operations of the angler, and by this means the numbers of Mayfly nymphs in the stream should be greatly increased. Dr. R. J. Tillyard has dealt at some length with this question, as regards Tasmanian conditions, in his paper, previously quoted. He says: "It would manifestly be unwise to disturb the balance of nature in Lake Leake by the introduction of other species of Mayflies until such time as . . . . observations have been carefully made. Further, a complete survey of the Mayfly fauna of the lake is required, including the life-histories and distribution of the species found there. When that has been done, the value of such an experiment as the introduction of the nymphs of the 'Penstock Brown' or other species of Mayfly can be scientifically calculated, and it may well be that such introductions may then be shown to be desirable for the improvement of trout-fishing.

"In the meanwhile, I think that the supply of this Mayfly [*Atalophlebia australis*] in the Macquarie River [Tasmania] could be augmented, or at any rate prevented from dropping, by a judicious use of more or less decayed timber, such as rotten logs. When old willows or gum-trees are cleared away near the river, they might be cut into suitable lengths, and placed in various parts of the river in such a way that they are not likely to become snags for the anglers. The Mayfly nymphs will find their way to these logs in large numbers, and, hiding in their cracks and crannies, proceed to obtain a rich living from the vegetable material which collects on them and from the products of their decay. In Lake Leake there would appear to be already a plentiful supply of decaying wood, since part of the area submerged to form this lake was originally forest. This is probably one of the chief reasons for the abundance and large size of *Atalophlebia australis* on this artificial sheet of water."

Note on the Suitability of the Fish River.

From a careful examination of the material available, it would appear that the Fish River in the vicinity of Lithgow is wholly unsuited for the conservation of trout, and the existing small size of the fish is, apparently, wholly due to the scarcity of animal food available in, and in the vicinity of, these waters; indeed, it is remarkable that the fish manage to subsist, let alone attain even as much growth, upon the paucity of food revealed by the analysis of their stomach contents. In the upper reaches of the river in the Oberon district the conditions appear to be somewhat better, but even then the position does not seem wholly satisfactory, but more definite conclusions are precluded by lack of material for examination. The principal fish-food in the stream near Oberon appears to be Mollusca. In considering the figures of the other groups taken by the fish, the large number of 488 lepidopterous larvæ should be discounted, since the fish obtained these caterpillars during a season when the insects occurred in plague numbers.

It is highly desirable that more material should be obtained from the Fish River, and that in every case scale readings should be correlated with the stomach contents in order that we may obtain data regarding the relation of the food supply to the rate of growth. Such details would form valuable records in connection with any stream, and this aspect of the matter should on no account be lost sight of, for it forms an aspect of the investigation which should lead to valuable results, and in future investigation might well receive special attention. Rivers which might receive such special attention on these lines are the Fish, Barrington, Tuross, McLaughlin and Kybean.

In conclusion, I desire to express my appreciation of the encouragement and assistance received from the Council and members of the New South Wales Rod Fishers' Society, especially to Drs. C. Anderson and A. Glen; Messrs. G. H. Montgomery, F. W. Barrett, Jas. Gaden and R. W. Jenner for the collection and submission of the material for examination.

Thanks are especially due to Dr. A. J. Spiller Brandon, on whose advice and assistance I have been always able to rely throughout the course of the investigation, and it is due to his industry that we possess such a complete record of the food of the trout in the Tuross River; his kindness in rendering possible my visit to the Tuross River has already been mentioned.

General Summary of Food of Rainbow Trout.

Stomachs examined	108
Coleoptera	1,844
Trichoptera	778
Ephemeroptera	161
Lepidoptera	27
Hemiptera	329
Hymenoptera	62
Diptera	526
Odonata	82
Orthoptera	16
Isoptera	92
Perlaria	48
Neuroptera (Mantispidæ)	1
Thysanoptera	17
Arachnida	102
Myriapoda	1
Vermes	7
Crustacea	102
Amphibia	21
Pisces	77

Stomach Contents of Rainbow Trout.

(*Salmo irideus* Gibbons.)

Barrington River, Barrington Tops.

No. 1.—♀, 1 lb.; 13 November, 1935, 12 (noon). Collected by Mr. H. Clode. Fly: Anderson's Brown Spinner. Coleoptera: 1 Scarabæid beetle (*Xyloryctus montanus*), 1 Carab beetle (*Helluo* sp.), 2 *Heteronychus* sp., 2 *Cryptocephalus* sp., 1 Tenebrionid beetle (? gen. et sp.), 2 Click beetles (Elateridæ—? gen. et sp.). Hemiptera: 1 Pentatomid bug (*Scutiphora rubromaculata*). Trichoptera: 1 Caddis case (sand). Diptera: 27 Chironomid larvæ. Lepidoptera: 1 Lepidopterous larva. Hymenoptera: 1 Sawfly (Tenthredinidæ), 2 Bees (? gen. et sp.), 1 Ant (*Polyrachis* sp.), 3 winged ants (? gen. et sp.). Crustacea: Claw of small Yabbie (*Parachæraps bicarinatus*). Miscellaneous: Vegetable matter. Large quantity of Algæ. *Note*: Scale readings by Dr. A. J. Spiller Brandon showed: Age, 3½ years. Length, 1st year, 4½ inches; 2nd year, 11 inches; 3rd year, 13 inches; 3¼ year, 13¼ inches. Spawned in 3rd year.

No. 2.—? sex, 1 lb.; 13 November, 1935, 12 (noon). Collected by Mr. H. Clode. Fly: Anderson's Brown Spinner. Coleoptera: 2 Scarabæid beetles (*Xyloryctus montanus*). Ephemeroptera: 36 Mayfly nymphs. Odonata: 1 Zygopterid dragonfly nymph. Diptera: 27 Chironomid larvæ. Arachnida: 1 spider (? *Araneus* sp.). Miscellaneous: Small quantity of broken insect remains. *Note*: Scale readings showed: Age, 2½ years. Length: 1st year, 7 inches; 2nd year, 11 inches; 2¼ year, 12 inches. Not spawned.

No. 3.—? sex, 11 oz.; 13 November, 1935, 12 (noon). Collected by Mr. H. Clode. Fly: Anderson's Brown Spinner. Coleoptera: 1 Click beetle (Elateridæ—? gen. et sp.). Trichoptera: 4 Caddis cases (sand). Ephemeroptera: 2 Mayfly nymphs. Odonata: 3 Anisopterid nymphs, 1 Zygopterid dragonfly (imago) (? gen. et sp.). Crustacea: 1 small Yabbie claw (*Parachæraps bicarinatus*). Miscellaneous: Small quantity of unidentifiable insect remains. Vegetable matter: Several long grass-stems. *Note*: Scale readings showed: Age, 2¼ years. Length: 1st year, 4½ inches; 2nd year, 10¼ inches; 2¼ year, 11 inches. Not spawned.

No. 4.—? sex, 10 oz.; 13 November, 1935, 10 a.m. Collected by Mr. H. Clode. Fly: Anderson's Brown Spinner. Coleoptera: 1 Pumpkin beetle (*Ceratia hilaris*), remains of an unidentifiable beetle. Trichoptera: 1 Caddis case (sand). Miscellaneous: A small quantity of finely broken insect remains. *Note*: Scale readings showed: Age, 2½ years. Length: 1st year, 6 inches; 2nd year, 10 inches; 2¼ year, 10¼ inches. Not spawned.

No. 5.—? sex, ½ lb.; 13 November, 1935, 10 a.m. Collected by Mr. H. Clode. Fly: Anderson's Brown Spinner. Coleoptera: 2 small Dytiscid beetles (? gen. et sp.), remains of large unidentifiable beetle. Trichoptera: 5 Caddis cases (sand). Diptera: 22 Chironomid larvæ. Crustacea: 2 Copepods (? gen. et sp.). *Note*: Scale readings showed: Age 2¼ years. Length: 1st year, 4 inches; 2nd year, 8½ inches; 2¼ year, 9½ inches. Not spawned.

No. 6.—? sex, ¾ lb.; 13 November, 1935. Collected by Mr. J. Teasey. Fly: R.A.B. Coleoptera: 1 Dytiscid beetle (? gen. et sp.). Diptera: 4 Chironomid larvæ. *Note*: Scale readings showed: Age, 2¼ years. Length, 1st year, 4 inches; 2nd year, 10 inches; 2¼ year, 11¼ inches. Not spawned.

No. 7.—? sex, ½ lb.; 13 November, 1935. Collected by Mr. J. Teasey. Fly: Cochybondu. Coleoptera: 1 *Telephorus pulchellus*. Trichoptera: 1 Caddis case (sand). Ephemeroptera: 1 Mayfly nymph. Odonata: 2 Anisopterid nymphs (1 *Æschna*, 1 *Libellula*). Diptera: 5 Chironomid larvæ. *Note*: Scale readings showed: Age 2¼ years. Length: 1st year, 5 inches; 2nd year, 9½ inches; 2¼ year, 10 inches. Not spawned.

No. 8.—? sex, ¾ lb.; 13 November, 1935, 3 p.m. Collected by Dr. C. Anderson. Fly: Soldier Palmer. Coleoptera: 2 *Paropsis* sp., 6 Scarabæid beetles (*Heteronyx* sp.), remains of Cistelid beetle. Trichoptera: 2 Caddis flies (? gen. et sp.). Ephemeroptera: 2 Mayfly nymphs. Diptera: 15 Chironomid larvæ, 1 *Bibio* sp. Hymenoptera: 1 Ant (*Iridomyrmex rufoniger*). Crustacea: 1 small Yabbie (*Parachæraps bicarinatus*), 1 Copepod (? gen. et sp.). Miscellaneous insects: Small quantity broken insect remains. *Note*: Scale readings showed: Age, 2½ years. Length: 1st year, 6 inches; 2nd year, 10 inches; 2¼ year, 10¼ inches. Not spawned.

No. 9.—? sex, ? weight; 14 November, 1935. Collected by Mr. H. Clode: Fly: R.A.B. Coleoptera: 3 Click beetles (Elateridæ—? gen. et sp.), 3 small beetles (unidentifiable). Ephemeroptera: 8 Mayflies (? gen. et sp.). Diptera: 1 Bombyliid fly (? gen. et sp.). Miscellaneous insects: Quantity of finely triturated and unidentifiable insect remains.

No. 10.—? sex, ? weight; 14 November, 1935. Collected by Mr. H. Clode. Coleoptera: 1 Ladybird beetle (*Leis conformis*). Trichoptera: 30 Caddis cases (sand). Ephemeroptera: 2 Mayfly nymphs, 1 imago. Diptera: 4 Chironomid midges, and quantity of pupal skins. Miscellaneous insects: Small quantity of broken insect remains.

No. 11.—? sex, ? weight; 14 November, 1935. Collected by Mr. H. Clode. Fly: R.A.B. Trichoptera: 63 Caddis cases (sand). Ephemeroptera: 1 Mayfly. Lepidoptera: 2 small moths (? gen. et sp.). Miscellaneous insects: Small quantity of unidentifiable remains.

No. 12.—? sex, ? weight; 14 November, 1935. Collected by Mr. H. Clode. Fly: R.A.B. Coleoptera: 1 Click beetle (Elateridæ—? gen. et sp.), 1 Soldier beetle (*Telephorus pulchellus*). Trichoptera: 9 Caddis cases (sand). Lepidoptera: 1 small moth (unidentifiable). Diptera: 5 Chironomid midges. Hymenoptera: 2 winged ants (? *Iridomyrmex*). Miscellaneous insects: Quantity insect remains.

No. 13.—? sex, ? weight; 14 November, 1935. Collected by Mr. H. Clode. Fly: R.A.B. Coleoptera: 2 Scarabæid beetles (*Heteronyx* sp.). Trichoptera: 25 Caddis cases (sand). Ephemeroptera: 1 Mayfly nymph. Odonata: 1 Anisopterid nymph. Diptera: 11 Chironomid midges. Hymenoptera: 1 Ichneumon wasp (? gen. et sp.), 1 Ant (*Iridomyrmex rufoniger*). Miscellaneous insects: Quantity of unidentifiable insect remains.

No. 14.—? sex, 1 lb.; 14 November, 1935. Collected by Mr. H. Clode. Fly: Coachman. Coleoptera: 1 Scarabæid beetle (*Heteronyx* sp.), 1 Soldier beetle (*Telephorus pulchellus*). Odonata: 1 Anisopterid nymph. Diptera: 57 Chironomid larvæ, 1 Bibionid fly. Miscellaneous insects: Quantity of broken remains.

No. 15.—? sex, ? weight; 15 November, 1935. Collected by Dr. C. Anderson. Coleoptera: 1 Dryopid beetle (? gen. et sp.). *Note*: Scale reading shows: Age, 2¼ years. Length: 1st year, 3 inches; 2nd year, 10 inches; 2¼ year, 11 inches. Not spawned.

No. 16.—? sex, ? weight; 15 November, 1935. Collected by Dr. C. Anderson. Coleoptera: 1 Scarabæid beetle (*Heteronyx* sp.), 1 Click beetle (Elateridæ—? gen. et sp.). Trichoptera: 10 Caddis cases (sand). Odonata: 2 Anisopterid nymphs. *Note*: Scale reading shows: Age, 2¼ years. Length: 1st year, 3 inches; 2nd year, 10 inches; 2¼ year, 11¼ inches. Not spawned.

No. 17.—♀, 1½ lb.; 15 November, 1935. Collected by Mr. H. Clode. Fly: Brown Hopper Hackle. Coleoptera: 2 Ladybird beetles (*Leis conformis*), 1 *Paropsis* sp., 4 Scarabæid beetles (*Xyloryctus monticola*). Odonata: 6 Anisopterid nymphs. Orthoptera: 1 Grasshopper (? gen. et sp.). Miscellaneous insects: Small quantity of triturated remains. Vegetable matter: Quantity of grass. *Note*: Scale reading shows: Age, 3¼ years. Length: 1st year, 6½ inches; 2nd year, 11 inches; 3rd year, 13¼ inches; 3¼ year, 14¼ inches. Spawned in 3rd year.

No. 18.—♂, 14 oz.; 11 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Hardy's Favourite. Coleoptera: 1 *Paropsis* sp., 3 Scarabæid beetles (*Heteronyx* sp.), 2 *Diphucephala* sp., 1 small Elaterid (? gen. et sp.). Trichoptera: 19 Caddis cases (sand). Orthoptera: 1 Grasshopper (? gen. et sp.). Crustacea: 1 small Yabbie (*Parachæraps bicarinatus*). Miscellaneous insects: Quantity of unidentifiable remains.

No. 19.—♀, 10 oz.; 12 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Silver Doctor. Coleoptera: 3 Scarabæid beetles (*Heteronyx* sp.). Trichoptera: 3 Caddis cases (sand). Ephemeroptera: 4 Mayflies and wings of many others. Odonata: Wings of Anisopterid dragonflies. Miscellaneous insects: Small quantity of remains.

No. 20.—♀, 12 oz.; 12 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Royal Coachman. Coleoptera: 7 Scarabæid beetles (*Heteronyx* sp.), 12 *Diphucephala* sp., and remains of many others. Miscellaneous insects: Quantity of finely broken insect remains.

No. 21.—♂, 1 lb.; 12 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Red Tag Palmer. Coleoptera: 1 small Click beetle (Elateridæ—? gen. et sp.). Trichoptera: 25 Caddis cases (sand). Crustacea: 1 small Yabbie (*Parachæraps bicarinatus*).

No. 22.—♀, 9 oz.; 12 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Coachman. Coleoptera: 5 *Heteronyx* sp., 1 *Diphucephala* sp., 1 Elaterid (? gen. et sp.), 1 *Cisseis maculata* (?). Ephemeroptera: 1 Mayfly. Isoptera: 1 winged Termite. Miscellaneous insects: Small quantity of unidentifiable remains.

No. 23.—♀, 8 oz.; 14 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Ginger Palmer. Coleoptera: 1 *Diphucephala* sp., 1 small Click beetle (Elateridæ—? gen. et sp.). Trichoptera: 1 Caddis case (sand). Ephemeroptera: 1 Mayfly nymph.

No. 24.—♂, 9 oz.; 14 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Zulu. Trichoptera: 18 Caddis cases (sand).

No. 25.—♀, 10 oz.; 14 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Zulu. Coleoptera: 1 *Heteronyx* sp. Trichoptera: 54 Caddis cases (sand).

No. 26.—♀, 10 oz.; 15 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Red Tag Palmer. Ephemeroptera: 4 Mayfly nymphs. Odonata: 1 Anisopterid nymph. Lepidoptera: 3 moths (? gen. et sp.). Myriapoda: 1 large millepede.

No. 27.—♂, 8 oz.; 15 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Zulu. Trichoptera: 3 Caddis cases (stick). Odonata: 1 Anisopterid dragonfly and quantity of wings, 1 Anisopterid nymph, wings of Zygopterid dragonflies. Lepidoptera: 1 moth (unidentifiable). Miscellaneous insects: Small quantity of broken remains.

No. 28.—♀, 8 oz.; 15 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Coachman. Trichoptera: 37 Caddis cases (sand). Hymenoptera: 1 Ichneumon wasp (? gen. et sp.). Crustacea: 68 Copepods (? Gammaridæ).

No. 29.—♀, 10 oz.; 15 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Hardy's Favourite. Trichoptera: 33 Caddis cases (sand). Odonata: 1 Anisopterid nymph.

No. 30.—♂, 18 oz.; 18 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Tomalla Hackle. Coleoptera: 2 *Diphucephala* sp., 2 Chrysomelid beetles (? gen. et sp.), 9 Scarabæid beetles (*Heteronyx* sp.), 2 small Click beetles (Elateridæ —? gen. et sp.). Trichoptera: 7 Caddis cases (stick). Ephemeroptera: 2 Mayflies and wings of others. Odonata: Wings of Zygopterid dragonflies. Hymenoptera: 7 winged ants (*Iridomyrmex* sp.), 1 worker ant (*Iridomyrmex rufoniger*). Miscellaneous insects: Large quantity of finely broken and unidentifiable remains.

No. 31.—♀, 10 oz.; 17 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Coachman. Stomach empty.

No. 32.—♀, 14 oz.; 16 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Zulu. Coleoptera: 1 Soldier beetle (*Telephorus pulchellus*), 1 small Elaterid. Trichoptera: 2 Caddis cases (sand), 7 Mayfly nymphs. Amphibia: Bones of a small frog and quantity of frog ova. Miscellaneous: Vegetable matter, a small quantity.

No. 33.—♂, 14 oz.; 16 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Hardy's Favourite. Coleoptera: 4 *Heteronyx* sp. Trichoptera: 4 Caddis cases (sand). Ephemeroptera: 3 Mayflies and quantity of wings. Odonata: 1 Anisopterid nymph. Vermes: 2 Gordian worms. Crustacea: 1 small Yabbie (*Parachœraps bicarinatus.*)

No. 34.—♀, 20 oz.; 16 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Hare's Ear. Coleoptera: Remains of large Scarabæid beetle (? *Anoplognathus*), 1 *Paropsis* larva. Trichoptera: 2 Caddis cases (sand). Miscellaneous: 1 feather.

No. 35.—♀, 10 oz.; 16 December, 1935. Collected by Mr. G. H. Montgomery. Fly: Palmer. Trichoptera: 27 Caddis cases (sand). Crustacea: 23 Copepods (? Gammaridæ).

Summary of Food of Rainbow Trout, Barrington River.

Stomachs examined	35
Coleoptera	114
Trichoptera	328
Ephemeroptera	76
Lepidoptera	8
Hemiptera	1
Hymenoptera	21
Diptera	180
Odonata	22

Orthoptera	2
Isòptera	1
Arachnida	1
Myriapoda	1
Vermes	3
Crustacea	100
Amphibia	1

McLaughlin River.

No. 36.—♀, 2 lb.; 13 October, 1935, 11 a.m. Collected by Mr. F. W. Barrett. Fly: Jungle Cock. Coleoptera: 250 small Dytiscid beetles (*Necterosoma penicillata*), 2 small Dytiscid beetles (? gen. et sp.), and a quantity of unidentifiable Coleopterous remains. Hemiptera: 9 *Corixa* sp. Diptera: 2 *Conops* sp. (Cyrtidæ). Trichoptera: 1 Caddis larva.

No. 37.—♂, 2 lb.; 13 October, 1935, 9.30 a.m. Collected by Mr. F. W. Barrett. Fly: Jungle Cock. Coleoptera: 203 small Dytiscid beetles (*Necterosoma penicillata*), 2 Dung-beetles (*Onthophagus* sp.), 1 small Carab beetle (? gen. et sp.). Trichoptera: 4 Caddis cases (sand). Ephemeroptera: 25 Mayfly nymphs, 3 Mayflies. Lepidoptera: 6 small moths (? gen. et sp.), 1 Lepidopterous larva. Diptera: 5 Stratiomyiid larvæ (*Odontomyia*), 3 Mycetophyllid midges. Hymenoptera: 1 Greenhead ant (*Chalcoponera metallica*). Hemiptera: 9 *Corixa* sp. Orthoptera: 4 Grasshoppers (*Paratettix* sp.). Miscellaneous insects: Large quantity of unidentifiable remains. Crustacea: 1 Shrimp (*Paratya australiensis*). Vegetable matter: Large quantity of Algæ.

No. 38.—♀, 3½ lb.; 13 October, 1935, 9.30 a.m. Collected by Mr. F. W. Barrett. Fly: Jungle Cock. Coleoptera: 320 small Dytiscid beetles (*Necterosoma penicillata*). Diptera: 6 Stratiomyiid larvæ (*Odontomyia*). Miscellaneous: Quantity of mud.

No. 39.—♀, 2¾ lb.; 14 October, 1935, 5 p.m. Collected by Mr. F. W. Barrett. Coleoptera: 9 Coleopterous larvæ, remains of a Scarabæid beetle, 2 small Dytiscid beetles (*Necterosoma penicillata*). Odonata: 4 Anisopterid nymphs. Amphibia: Bones of a small frog. Miscellaneous: Quantity of mud.

No. 40.—♀, 2¼ lb.; 15 October, 1935, 6 p.m. Collected by Mr. F. W. Barrett. Coleoptera: 1 Carab beetle (? gen. et sp.), 90 small Dytiscid beetles (*Necterosoma penicillata*), 2 Coleopterous larvæ, 1 large Hydrophylid larva. Trichoptera: 1 Caddis case (stick). Ephemeroptera: 1 large Mayfly nymph. Miscellaneous: 2 pebbles. Vegetable matter: A very large quantity of Algæ.

No. 41.—♀, 3 lb.; 16 October, 1935, 12 (noon). Collected by Mr. F. W. Barrett. Coleoptera: 2 large Hydrophylid larvæ, 2 Gyrinid beetles (? gen. et sp.), 1 small Dytiscid beetle (? gen. et sp.), 35 small Dytiscid beetles (*Necterosoma penicillata*), 3 Coleopterous larvæ. Ephemeroptera: 34 Mayfly nymphs. Odonata: 2 Anisopterid nymphs. Diptera: 5 Stratiomyiid larvæ (*Odontomyia*), 52 Syrphid larvæ. Hemiptera: 23 *Corixa* sp. Orthoptera: Forceps of an Earwig (? *Labidura riparia*). Miscellaneous insects: Large quantity of finely broken and unidentifiable remains.

No. 42.—♂, 2¼ lb.; 16 October, 1935, 6.30 p.m. Collected by Mr. F. W. Barrett. Coleoptera: 26 small Dytiscid beetles (*Necterosoma penicillata*), 1 Weevil (? gen. et sp.), 1 small Carab beetle (? gen. et sp.). Trichoptera: 1 Caddis larva. Arachnida: 1 Spider (*Lycosa* sp.). Vegetable matter: Large quantity of Algæ.

No. 43.—♀, 2¼ lb.; 16 October, 1935, 10.30 a.m. Collected by Mr. F. W. Barrett. Coleoptera: 63 small Dytiscid beetles (*Necterosoma penicillata*), 7 large Hydrophilid larvæ, 3 small Carab beetles (? gen. et sp.). Ephemeroptera: 17 Mayflies. Perlaria: 18 Stoneflies (*Eusthenia* sp.). Lepidoptera: 1 moth (? gen. et sp.). Diptera: 18 Stratiomyiid larvæ (*Odontomyia*), 21 Syrphid larvæ, 1 Dipterous insect. Orthoptera: 1 Grasshopper (*Paratettix* sp.), forceps of Earwig (*Labidura riparia*). Miscellaneous insects: Large quanttiy of unidentifiable remains. Arachnida: 2 Spiders (*Lycosa* sp.). Vegetable matter: Mass of Algæ.

No. 44.—♀, 2¾ lb.; 17 October, 1935, 5 p.m.—Collected by Mr. F. W. Barrett. Fly: Special Jungle Cock. Trichoptera: 1 Caddis case (sand). Perlaria: 30 Stoneflies and nymphs (*Eusthenia* sp.). Hemiptera: 2 small *Corixa* sp. Amphibia: 1 Frog.

No. 45.—♂, 2¾ lb.; 18 October, 1935, 2.30 p.m. Collected by Mr. F. W. Barrett. Fly: Special Jungle Cock. Coleoptera: 3 large Hydrophilid larvæ, 7 small Dytiscid beetles (*Necterosoma penicillata*), 2 small Carab beetles (? gen. et sp.), 1 Dytiscid beetle (? gen. et sp.). Ephemeroptera: 13 Mayflies and remains of many others. Lepidoptera: 2 small moths (unidentifiable). Diptera: 3 Dipterous pupæ (? Tipulidæ), 5 Stratiomyiid larvæ (*Odontomyia*). Hemiptera: 2 *Corixa* sp. Orthoptera: 1 Grasshopper (*Paratettix* sp.), 1 Cockroach (*Panesthia granicollis*). Miscellaneous insects: Small quantity of broken remains. Vermes: Remains of a worm (unidentifiable). Amphibia: Bones of a small frog.

No. 46.—♂, 3½ lb.; 18 October, 1935, 3.30 p.m. Collected by Mr. F. W. Barrett. Fly: Special Jungle Cock. Coleoptera: 5 small Carab beetles (? gen. et sp.), 5 large Hydrophylid larvæ, 1 Dryopid larva, 1 Click beetle (Elateridæ—? gen. et sp.), 8 small Dytiscid beetles (*Necterosoma penicillata*), 1 Coleopterous larva. Trichoptera: 1 Caddis case (stick). Ephemeroptera: 68 large Mayflies and considerable quantity of remains. Odonata: 5 Anisopterid nymphs. Lepidoptera: 1 moth (? gen. et sp.). Diptera: 6 Stratiomyiid larvæ (*Odontomyia*), 14 Dipterous pupæ (? Stratiomyiidæ). Hymenoptera: 1 winged ant (? gen. et sp.), 1 Hive Bee (*Apis mellifera*), 1 Ichneumon wasp (? gen. et sp.). Orthoptera: 3 Grasshoppers (*Paratettix* sp.), 1 Cockroach (*Panesthia granicollis*). Miscellaneous insects: Large quantity of unidentifiable remains. Arachnida: Cephalothorax and chelicerae of Spider (*Lycosa* sp.). Amphibia: Mass of ova (? frog).

No. 47.—♀, 3 lb.; 18 October, 1935, 10.30 a.m. Collected by Mr. F. W. Barrett. Fly: Special Jungle Cock. Coleoptera: 1 large Hydrophilid larva, 1 small Dytiscid beetle (*Nectosoma penicillata*). Odonata: 2 Anisopterid nymphs. Lepidoptera: 1 small moth (? gen. et sp.). Hemiptera: 1 *Corixa* sp.

No. 48.—♂, ? weight; 11 November, 1935. Collected by Mr. Jas. Gaden. Fly: Claret and Mallard. Coleoptera: 117 small Dytiscid beetles (*Necterosoma penicillata*). Odonata: 1 Anisopterid nymph. Arachnida: 1 Spider (*Araneus* sp.).

No. 49.—♀, ? weight; 10 November, 1935, 4 p.m. Collected by Mr. Jas. Gaden. Fly: Claret and Mallard. Coleoptera: 16 small Dytiscid beetles (*Necterosoma penicillata*).

No. 50.—♀, ? weight; 11 November, 1935, 12.30 p.m. Collected by Mr. Jas. Gaden. Fly: Claret and Mallard. Coleoptera: 17 small Dytiscid beetles (*Necterosoma penicillata*). Diptera: 5 Chironomid pupæ.

No. 51.—♀, ? weight; 11 November, 1935, 2.20 p.m. Collected by Mr. Jas. Gaden. Amphibia: Remains of a frog.

No. 52.—♀, ? weight; 11 November, 1935, 3.30 p.m. Collected by Mr. Jas. Gaden. Coleoptera: 2 small Dytiscid beetles (*Necterosoma penicillata*).

No. 53.—♀, ? weight; 11 November, 1935, 4 p.m. Collected by Mr. Jas. Gaden. Stomach empty.

No. 54.—♂, 3 lb.; 1 December, 1935, 11 a.m. Collected by Mr. Walter Forbes. Coleoptera: 1 Gyrinid beetle (? gen. et sp.). Ephemeroptera: 4 Mayfly nymphs. Diptera: 6 Stratiomyiid larvæ (*Odontomyia*). Hemiptera: 1 *Corixa* sp. Miscellaneous insects: Quantity of unidentifiable remains. Amphibia: 3 Frogs. Pisces: 3 small fish fry (much digested). *Note*: It proved impossible to identify these fry, but they were not those of trout.

No. 55.—♀, 2½ lb.; 2 December, 1935, 3 p.m. Collected by Mr. Walter Forbes. Fly: Large Jungle Cock. Coleoptera: 28 small Dytiscid beetles (*Necterosoma penicillata*). Trichoptera: 2 Caddis cases (sand). Ephemeroptera: Wings of Mayflies. Diptera: 73 Chironomid pupæ. Hemiptera: 1 *Notonecta* sp. Orthoptera: 2 Earwigs (*Labidura riparia*). Pisces: 7 fish fry (much digested). Vegetable matter: 1 large piece of bark, 3 inches long. *Note*: The fish fry were definitely not trout.

No. 56.—♀, 3 lb. 4 oz.; 3 December, 1935, 11.40 a.m. Collected by Mr. Walter Forbes. Fly: Jungle Cock. Pisces: 66 fish fry and large quantity of remains (much digested). *Note*: The fish fry, although unidentifiable, were not those of trout.

No. 57.—♀, 2½ lb.; 4 December, 1935, 11 a.m. Collected by Mr. Walter Forbes. Stomach empty.

No. 58.—♂, 2 lb. 14 oz.; 4 December, 1935, 2 p.m. Collected by Mr. Walter Forbes. Fly: Jungle Cock. Coleoptera: 23 small Dytiscid beetles (*Necterosoma penicillata*). Lepidoptera: 4 moths (unidentifiable). Diptera: 1 Tipulid (*Macromastyx costalis*), 1 Stratiomyiid fly (? gen. et sp.). Hemiptera: 1 *Corixa* sp. Miscellaneous insects: Quantity of unidentifiable insect remains. Arachnida: 1 Spider (*Araneus* sp.). Vegetable matter: A very large quantity of Algæ.

No. 59.—♂, 1¾ lb.; 4 December, 1935, 6 p.m. Collected by Mr. Walter Forbes. Fly: Ginger Hackle and Red. Coleoptera: 2 small Dytiscid beetles (*Necterosoma penicillata*).

No. 60.—♀, 2½ lb.; 6 December, 1935, 11.15 a.m. Collected by Mr. L. Forbes. Fly: Jungle Cock. Ephemeroptera: 5 Mayfly nymphs. Hemiptera: 57 small *Corixa* sp.

No. 61.—♀, 3¼ lb.; 17 January, 1936, 10 a.m. Collected by Dr. A. Glen. Odonata: 1 Zygopterid dragonfly nymph. Hemiptera: 1 *Notonecta* sp., 1 *Corixa* sp.

No. 62.—♀, 3¾ lb.; 17 January, 1936, 11 a.m. Collected by Dr. A. Glen. Fly: Jungle Cock. Trichoptera: 2 Caddis cases (sand). Odonata: 2 Zygopterid nymphs. Hemiptera: 2 *Corixa* sp., 1 *Notonecta* sp.

No. 63.—♂, 3¼ lb.; 17 January, 1936, 12.30 p.m.—Collected by Dr. A. Glen. Fly: Jungle Cock. Stomach empty.

No. 64.—♀, 3¼ lb.; 17 January, 1936, 1 p.m. Collected by Dr. A. Glen. Coleoptera: 8 small Dytiscid beetles (*Necterosoma penicillata*). Trichoptera: 3 Caddis cases (sand). Diptera: 3 Stratiomyiid larvæ (*Odontomyia*). Pisces: 1 fish egg (?). Miscellaneous: 2 pebbles. Vegetable matter: Small quantity of Algæ.

No. 65.—♀, ? weight; 18 January, 1936, 3.15 p.m. Collected by Dr. A. Glen. Coleoptera: 64 small Dytiscid beetles (*Necterosoma penicillata*). Trichoptera: 3 Caddis cases (sand). Hemiptera: 5 small *Corixa* sp. Vegetable matter: Small quantity of Algæ.

No. 66.—♀, ? weight; 18 January, 1936, 4 p.m. Collected by Dr. A. Glen. Fly: Jungle Cock. Coleoptera: 6 small Dytiscid beetles (*Necterosoma penicillata*). Trichoptera: 3 Caddis cases (stick), 1 Caddis case (sand). Hemiptera: 1 *Corixa* sp. Vegetable matter: Large quantity of Algæ.

No. 67.—♀, 2¼ lb.; 11 April, 1936, 1.15 p.m. Collected by Dr. A. Glen. Fly: Jungle Cock. Coleoptera: 6 small Dytiscid beetles (*Necterosoma penicillata*). Trichoptera: 2 Caddis cases (stick)—large, 1½ inches long. Hemiptera: 13 small *Corixa* sp. Arachnida: 1 Spider (*Araneus* sp.).

No. 68.—♀, 2¼ lb.; 11 April, 1936, 2 p.m. Collected by Dr. A. Glen. Coleoptera: 8 small Dytiscid beetles (*Necterosoma penicillata*), 2 Hydrophilid beetles (? gen. et sp.). Hemiptera: 1 small *Corixa* sp. Vegetable matter: Quantity of Algæ.

No. 69.—♂, 1¼ lb.; 11 April, 1936, 3 p.m. Collected by Mr. F. W. Barrett. Coleoptera: 1 small Dytiscid beetle (*Necterosoma penicillata*). Hemiptera: 1 small *Corixa* sp.

No. 70—♀, 1½ lb.; 11 April, 1936, 3.45 p.m. Collected by Mr. Jas. Gaden. Diptera: 46 Chironomid pupæ. Hemiptera: 127 small *Corixa* sp., 1 large *Corixa* sp. Miscellaneous: Quantity of mud.

No. 71.—♀, 3¼ lb.; 11 April, 1936, 4 p.m. Collected by Mr. Jas. Gaden. Coleoptera: 7 small Dytiscid beetles (*Necterosoma penicillata*). Trichoptera: 2 Caddis cases (sand). Diptera: 8 Chironomid pupæ. Hemiptera: 37 small *Corixa* sp., 1 large *Corixa* sp., 4 *Notonecta* sp. Vermes: 1 Gordian worm. Miscellaneous: Quantity of mud.

No. 72.—♀, 1½ lb.; 11 April, 1936, 4.15 p.m. Collected by Mr. Jas. Gaden. Hemiptera: 4 small *Corixa* sp.

Summary of Food of Rainbow Trout, McLaughlin River.

Stomachs examined	37
Coleoptera	1,377
Trichoptera	27
Ephemeroptera	170
Lepidoptera	15
Hemiptera	305
Hymenoptera	4
Diptera	283
Odonata	18
Orthoptera	14
Perlaria	48
Arachnida	7
Vermes	2
Crustacea	1
Amphibia	8
Pisces	77

Kybean River.

No. 73.—♀, 1¼ lb.; 6 November, 1935, 11 a.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 7 Coleopterous larvæ, 1 beetle (unidentifiable). Trichoptera: 86 Caddis cases (84 sand, 2 stick). Miscellaneous insects: Large quantity of finely broken remains. Amphibia: 1 frog.

No. 74.—♂, 2½ lb.; 6 November, 1935, 12.30 p.m. Collected by Dr. B. Craig. Coleoptera: 1 Scarabæid beetle (*Heteronyx* sp.). Trichoptera: 675 Caddis cases (sand). Odonata: 1 Zygopterid dragonfly. Miscellaneous insects: Quantity of remains. Arachnida: 1 Spider (? *Araneus* sp.). Amphibia: Bones of a frog. Vegetable matter: Blades of grass.

No. 75.—♂, 2 lb.; 6 November, 1935, 5 p.m. Collected by Dr. B. Craig. Trichoptera: 1,256 Caddis cases (sand), 2 Caddis cases (stick). Odonata: 1 Anisopterid nymph.

Summary of Food of Rainbow Trout, Kybean River.

Stomachs examined	3
Coleoptera	9
Trichoptera	2,019
Odonata	2
Arachnida	1
Amphibia	2

Big Badja River.

No. 76.—♂, 1¾ lb.; 1 October, 1935. Collected by Rev. W. A. Evans. Trichoptera: 1 Caddis case (stick). Odonata: 1 Anisopterid nymph.

No. 77.—♀, 1¼ lb.; 2 October, 1935. Collected by Rev. W. A. Evans. Amphibia: 6 frogs.

No. 78.—♀, 1lb .; 5 October, 1935 (Countegany Creek). Collected by Mr. F. W. Barrett. Coleoptera: 1 Click beetle (Elateridæ—? gen. et sp.). Trichoptera: 2 Caddis cases (stick). Miscellaneous: 3 quartz pebbles.

No. 79.—♀, 1¾ lb.; 19 October, 1935. Collected by Rev. W. A. Evans. Trichoptera: 3 Caddis cases (stick). Vegetable matter: Mass of roots.

No. 80.—♀, 2 lb.; 19 October, 1935. Collected by Rev. W. A. Evans. Trichoptera: 7 Caddis cases (sand), 8 Caddis cases (stick). Diptera: 1 Dipterous larva (? Stratiomyidæ).

No. 81.—♂, 2 lb.; 26 January, 1936. Collected by Rev. W. A. Evans. Coleoptera: 1 Scarabæid beetle (? gen. et sp.). Trichoptera: 1 Caddis case (stick). Odonata: 37 Zygopterid dragonflies, 1 Anisopterid dragonfly (imagines). Crustacea: 1 Shrimp (*Paratya australiensis*).

Summary of Food of Rainbow Trout, Badja River.

Stomachs examined	6
Coleoptera	2
Trichoptera	22
Diptera	1
Odonata	39
Crustacea	1
Amphibia	6

Numeralla River.

No. 82.—♀, 1½ lb.; 2 October, 1935. Collected by Rev. W. A. Evans. Coleoptera: 2 small Dytiscid beetles (*Necterosoma penicillata*). Trichoptera: 4 Caddis cases (sand). Diptera: 5 Mycetophyllid midges. Isoptera: 3 winged Termites.

Gungarlin River (Tributary of Snowy).

No. 83.—♀, 1¾ lb.; 16 December, 1935. Collected by Mr. R. J. Jenner. Fly: Red Lochardie, No. 3. Amphibia: 1 frog.

No. 84.—♀, 1¾ lb.; 17 December, 1935, 11 a.m. Collected by Mr. R. J. Jenner. Fly: Red Lochardie, No. 3. Coleoptera: 1 Scarabæid beetle (*Heteronyx* sp.), 1 Dynastid beetle (? gen. et sp.). Trichoptera: 10 Caddis cases (sand). Lepidoptera: 1 large moth (unidentifiable). Amphibia: 1 frog. Miscellaneous: Large feather.

Summary of Food of Rainbow Trout, Gungarlin River.

Stomachs examined	2
Coleoptera	2
Trichoptera	10
Lepidoptera	1

Tuross River.

No. 85.—♀, 1 lb.; 26 October, 1935, 1.30 p.m. Collected by Dr. Brown Craig. Trichoptera: 1 Caddis case (stick). Miscellaneous: Small quantity of sand.

No. 86.—♀, 1 lb.; 26 October, 1935, 1.30 p.m. Collected by Dr. Brown Craig. Coleoptera: 10 Elateridæ (? gen. et sp.), 1 Chrysomelid beetle, 1 Coleopterous larva, 3 Scarabæid beetles (*Heteronyx* sp.). Trichoptera: 5 Caddis cases (sand). Hymenoptera: 4 Thynnid wasps (3 ♂, 1 ♀). Miscellaneous insects: Quantity of unidentifiable remains.

No. 87.—♀, ¾ lb.; 30 October, 1935, 11.30 a.m. Collected by ?. Coleoptera: 1 Chrysomelid beetle (? gen. et sp.). Trichoptera: 26 Caddis cases (sand), 15 Caddis cases (stick). Miscellaneous insects: Small quantity of broken remains. Vegetable matter: Large quantity of unidentifiable vegetable remains.

No. 88.—♀, ¾ lb.; 30 October, 1935, 11.30 a.m. Collected by Dr. Brown Craig. Trichoptera: 14 Caddis cases (sand), 1 Caddis case (stick). Ephemeroptera: 2 Mayfly nymphs. Hymenoptera: 1 Thynnid wasp. Miscellaneous insects: Quantity of remains.

No. 89.—♀, 2 lb.; 30 October, 1935, 12.30 a.m. Collected by Dr. A. J. Spiller Brandon. Trichoptera: 4 Caddis cases (stick), 2 Caddis cases (sand). Ephemeroptera: 1 Mayfly nymph.

No. 90.—♀, ¾ lb.; 30 October, 1935, 3.30 p.m. Collected by Dr. Brown Craig. Trichoptera: 19 Caddis cases (sand), 2 Caddis cases (stick). Ephemeroptera: 2 Mayfly nymphs. Amphibia: Bones of a frog.

No. 91.—♀, 1¼ lb.; 31 October, 1935, 5 p.m. Collected by Mr. A. C. Ebsworth. Coleoptera: 1 *Paropsis* larva. Trichoptera: 8 Caddis cases (sand).

No. 92.—? sex, ? weight; 1 November, 1935, 5.15 p.m. Collected by Mr. A. C. Ebsworth. Coleoptera: 1 Scarabæid beetle (*Heteronyx* sp.). Trichoptera: 6 Caddis cases (stick), 7 Caddis cases (sand). Ephemeroptera: 1 Mayfly (imago), 1 Mayfly nymph.

No. 93.—? sex, ¾ lb.; 1 November, 1935, 5.30 p.m. Collected by Dr. Brown Craig. Coleoptera: 2 *Paropsis* spp., 4 Elateridæ (? gen. et spp.), 1 Longicorn beetle (unidentifiable), 1 Staphylinid beetle (*Cafius aureolatus*), 3 small Carab beetles (? gen. et sp.), 8 Chrysomelid beetles (? gen. et sp.), 1 Soldier beetle (*Telephorus pulchellus*), 40 *Heteronyx* sp. Trichoptera: 33 Caddis cases (sand), 2 Caddis-flies. Lepidoptera: 1 Lepidopterous larva. Hemiptera: 2 Pentatomid bugs (? gen. et sp.). Hymenoptera: 1 Thynnid wasp (♀), 1 Sawfly (? gen. et sp.), 1 wasp (unidentifiable), 2 flying Ants (? *Iridomyrmex*). Isoptera: 90 winged Termites and a very large quantity of wings. Thysanoptera: 1 *Idolothrips spectrum*. Miscellaneous insects: Very large quantity of finely broken and unidentifiable remains.

No. 94.—? sex, 1¼ lb.; 1 November, 1935, 6 p.m. Collected by Mr. A. C. Ebsworth. Coleoptera: Remains of an Elaterid, 10 *Heteronyx* sp., 1 *Paropsisterna octolineata*, 1 Chrysomelid beetle (? gen. et sp.), 2 small Carab beetles (? gen. et sp.), 2 *Cisseis* sp. (Buprestidæ). Hymenoptera: 1 Thynnid wasp (♀). Vermes: 1 Gordian worm. Vegetable matter: Stomach crammed with coarse unidentifiable vegetable matter.

No. 95.—? sex, ¾ lb.; 4 November, 1935, 5 p.m. Collected by Dr. Brown Craig. Coleoptera: 3 *Cryptocephalus* sp., 1 *Liparetrus* sp., 3 Soldier beetles (*Telephorus pulchellus*). Trichoptera: 3 Caddis cases (sand). Ephemeroptera: 1 Mayfly. Hemiptera: 6 Psyllids (Psyllidæ). Miscellaneous: Large quantity of mud.

No. 96.—♀, ¾ lb.; 7 November, 1935, 1 p.m. Collected by Mr. A. C. Ebsworth. Diptera: 1 Dipterous pupa. Amphibia: Bones of a small frog.

No. 97.—♀, ¾ lb.; 8 November, 1935, 12.30 p.m. Collected by Dr. Brown Craig. Trichoptera: 9 Caddis cases (sand). Ephemeroptera: 5 Mayflies. Odonata: 1 Zygopterid dragonfly (imago). Hymenoptera: 1 Thynnid wasp (♂), 1 Bee (? *Halictus* sp.). Diptera: 1 Mycetophyllid midge. Vegetable matter: Seed-vessel of a Eucalypt.

No. 98.—♀, 1 lb.; 8 November, 1935, 12 (noon). Collected by Mr. A. C. Ebsworth. Coleoptera: 2 Scarabæid beetles (*Heteronyx* sp.), 1 Carab beetle (? gen. et. sp.), 1 *Paropsis* sp., 1 Ladybird beetle (*Leis conformis*). Trichoptera: 7 Caddis cases (sand). Ephemeroptera: 2 Mayflies. Diptera: 1 small Asilid, 1 unidentifiable fly (? Asilid). Hymenoptera: 3 Thynnid wasps (1 ♂, 2 ♀). Miscellaneous insects: Small quantity of finely broken remains.

No. 99.—♀, 1 lb.; 22 December, 1935, 1 p.m. Collected by Dr. A. J. Spiller Brandon. Trichoptera: 5 Caddis cases (sand). Odonata: Wings of Zygopterid dragonflies.

No. 100.—♀, 1 lb.; 24 December, 1935, 1.30 p.m. Collected by Mr. W. H. Ifould. Coleoptera: 59 *Phyllotocus navicularis*, 23 Click beetles (Elateridæ—? gen. et spp.), 3 *Heteronyx* sp., 2 *Diphucephala* sp., 2 Soldier beetles (*Telephorus pulchellus*), 5 *Cryptocephala* sp., 1 Clerid beetle (? gen. et sp.), quantity of broken remains of Coleoptera. Hymenoptera: 3 Hive Bees (*Apis mellifera*), 2 native Bees (*Hylœus* sp.), 1 Bee (? gen. et sp.), 6 Thynnid wasps (2 ♂, 4 ♀), 1 Bee (*Halictus* sp.). Diptera: 1 Robber Fly (Asilidæ). Hemiptera: 1 Tree-hopper (? gen. et sp.).

No. 101.—? sex, 1¼ lb.; 24 December, 1935, 4 p.m. Collected by Mr. W. H. Ifould. Coleoptera: 28 Scarabæid beetles (*Phyllotocus navicularis*), 2 *Anoplognathus porosus*, 4 *Diphucephala* sp., 2 *Heteronyx* sp., 2 *Cryptocephalus* sp., 2 *Paropsis* sp., 2 Chrysomelid beetles (? gen. et sp.), 2 Soldier beetles (*Telephorus pulchellus*), 9 Click beetles (Elateridæ—? gen. et spp.), 2 unidentifiable beetles (? Tenebrionidæ). Diptera: 1 Asilid fly (? gen. et sp.). Hymenoptera: 3 Thynnid wasps (2 ♂, 2 ♀), 1 Bee (*Euryglossa* sp.), 1 Ichneumon wasp (? gen. et sp.), 1 winged Ant (*Iridomyrmex* sp.). Mantispidæ: 1 Mantispid (? gen. et sp.). Miscellaneous insects: Large quantity of finely divided remains.

No. 102.—♀, 2 lb.; 28 December, 1935, 4 p.m. Collected by Mr. W. H. Ifould. Coleoptera: 1 Scarabæid beetle (*Heteronychus arator*), 5 *Phyllotocus navicularis*, 1 Click beetle (Elateridæ—? gen. et sp.). Trichoptera: 3 Caddis cases (stick). Hymenoptera: 1 Bee (*Halictus* sp.). Miscellaneous insects: Small quantity of remains.

No. 103.—♀, 1 lb.; 28 December, 1935, 4.30 p.m. Collected by Mr. W. H. Ifould. Coleoptera: 4 Click beetles (Elateridæ—? gen. et sp.), 8 Scarabæid beetles (*Phyllotocus navicularis*). Odonata: Wings of Zygopterid dragonflies. Lepidoptera: 1 moth (unidentifiable). Diptera: 1 Asilid fly (? gen. et sp.). Hemiptera: 1 *Corixa* sp. Miscellaneous insects: Quantity of broken and unidentifiable remains.

No. 104.—♀, 1 lb.; 18 January, 1936, 6 p.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 *Anoplognathus porosus*, 4 *Phyllotocus navicularis*, 2 small Dytiscid beetles (*Necterosoma penicillata*), remains of unidentifiable beetle. Lepidoptera: 1 small moth (? gen. et sp.). Miscellaneous insect remains.

No. 105.—♀, ½ lb.; 18 January, 1936, 1.30 p.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 9 *Diphucephala* sp., 1 *Cryptocephala* sp., 6 Elateridæ (? gen. et spp.), 4 *Anoplognathus porosus*, 2 *Melobasis* sp. (Buprestidæ), 1 *Stigmodera* sp. (Buprestidæ), 1 Clerid beetle (? gen. et sp.), 1 small Scarabæid beetle (? gen. et sp.), large quantity of Coleopterous remains. Thysanoptera: 8 *Idolothrips spectrum*. Miscellaneous insects: Quantity of remains. Arachnida: 1 Spider (? gen. et sp.). Vermes: 1 Gordian worm.

No. 106.—♀, 10 oz., 21 January, 1936, 12 (noon). Collected by Mr. J. Harnett. Coleoptera: 16 Scarabæid beetles (*Heteronyx* sp.), 1 *Anoplognathus porosus*. Trichoptera: 1 Caddis case (sand). Diptera: 1 Chironomid pupa.

No. 107.—♀, 1 lb.; 3 February, 1936, 11 a.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 *Heteronyx* sp., 1 *Telura* sp. (Scarabæidæ). Trichoptera: 4 Caddis cases (sand). Hymenoptera: 1 large Sphecid wasp (? gen. et sp.). Miscellaneous insects: Quantity of broken remains.

No. 108.—♀, 1¾ lb.; 23 February, 1936, 6 p.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 10 *Cryptocephalus* sp., 2 *Heteronyx* sp. Trichoptera: 3 Caddis cases (sand). Diptera: 53 Chironomid midges, 1 Crane fly (Tipulidæ—? gen. et sp.). Hemiptera: 2 Rutherglen bugs (*Nysius vinitor*), 10 Tree-hoppers (? gen. et sp.), 1 *Ledra* sp. Thysanoptera: 8 *Idolothrips spectrum*. Isoptera: 1 winged Termite. Miscellaneous insects: Large quantity of broken and unidentifiable remains, mostly those of Diptera and Hymenoptera.

Summary of Food of Rainbow Trout, Tuross River.

Stomachs examined	24
Coleoptera	340
Trichoptera	180
Ephemeroptera	15
Lepidoptera	3
Hemiptera	23

Hymenoptera	37
Diptera	62
Odonata	1
Isoptera	91
Thysanoptera	17
Mantispidæ	1
Arachnida	1
Vermes	2
Amphibia	2

General Summary of Food of Brown Trout.

Stomachs examined	73
Coleoptera	512
Trichoptera	1,501
Ephemeroptera	73
Lepidoptera	493
Hemiptera	114
Hymenoptera	116
Diptera	2,043
Odonata	110
Orthoptera	29
Isoptera	100
Perlaria	1
Thysanoptera	15
Arachnida	9
Myriapoda	15
Vermes	3
Crustacea	6
Mollusca	244
Amphibia	8

Stomach Contents of Brown Trout.

(*Salmo fario* Linnæus.)

Fish River, Oberon.

No. 1.—♂, 1¾ lb.; 27 October, 1935. Collected by Mr. W. Smith. Coleoptera: 1 Ladybird beetle (*Leis conformis*), elytron of beetle (unidentifiable).

No. 2.—♀, 1 lb.; 27 October, 1935. Collected by Mr. W. Smith. Coleoptera: 1 Elaterid (? gen. et sp.), 1 Ladybird beetle (*Leis conformis*), 1 Dryopid beetle (? gen. et sp.). Hymenoptera: 8 winged Ants (? *Iridomyrmex* sp.). Mollusca: 37 *Bullinus* sp., 1 *Planorbis* sp.

No. 3.—♀, 1 lb.; 27 October, 1935. Collected by Mr. W. Smith. Coleoptera: 10 Ladybird beetles (*Leis conformis*). Mollusca: 6 *Bullinus* sp.

No. 4.—♂, 1¾ lb.; 27 October, 1935, 6.30 a.m. Collected by Mr. W. Smith. Coleoptera: 5 Staphylinid beetles (*Cafius areolatus*), 10 Elateridæ (? gen. et spp.), 14 Ladybird beetles (*Leis conformis*), 1 Dung beetle (*Onthophagus* sp.), 3 small Carab beetles (? gen. et sp.). Hymenoptera: 4 winged ants (? gen. et sp.). Orthoptera: 1 Mole Cricket (*Gryllotalpa australis*), 3 small Grasshoppers (*Paratettix* sp.). Miscellaneous insects: Quantity of remains.

No. 5.—? sex, ? weight; December, 1935. Collected by ?. Coleoptera: 6 Scarabæid beetles (*Heteronyx* sp.), 1 Soldier beetle (*Telephorus pulchellus*). Odonata: 1 Anisopterid dragonfly. Lepidoptera: 434 Army Worm Caterpillars (Noctuidæ). Orthoptera: 5 Grasshoppers (*Calataria terminifera*) (mature), 2 Grasshoppers (immature). Miscellaneous insects: Quantity of remains.

No. 6.—? sex, ? weight; December, 1935. Collected by ?. Coleoptera: 1 *Heteronyx* sp. Lepidoptera: 53 Army Worm Caterpillars (Noctuidæ). Orthoptera: 1 large immature Grasshopper. Mollusca: 102 *Bullinus* sp., 5 *Planorbis* sp.

No. 7.—? sex, ? weight; December, 1935. Collected by ?. Coleoptera: 12 Ladybird beetles (*Leis conformis*), 2 Dung beetles (*Onthophagus granicollis*), 2 *Diphucephala* sp. Ephemeroptera: 1 Mayfly. Hemiptera: 6 *Gerris* sp. Lepidoptera: 1 moth (? gen. et sp.). Hymenoptera: 1 Evaniid wasp (? gen. et sp.), 3 small Sawflies (? gen. et sp.), 1 Thynnid wasp (♀). Orthoptera: 8 immature Grasshoppers, 1 small Cricket (? gen. et sp.). Mollusca: 56 *Bullinus* sp., 27 *Planorbis* sp.

No. 8.—? sex, ? weight; December, 1935. Collected by ?. Orthoptera: 1 immature Grasshopper. Mollusca: 10 *Bullinus* sp.

No. 9.—? sex, ? weight; December, 1935. Collected by ?. Coleoptera: 3 Ladybird beetles (*Leis conformis*), 1 *Heteronyx* sp., 1 Dung beetle (*Onthophagus granicollis*). Odonata: 1 Anisopterid nymph. Hymenoptera: 2 Thynnid wasps (♂♂). Orthoptera: 1 immature Grasshopper.

Summary of Food of Brown Trout, Fish River.

Stomachs examined	9
Coleoptera	77
Ephemeroptera	1
Lepidoptera	488
Hemiptera	6
Hymenoptera	19
Odonata	2
Orthoptera	23
Mollusca	244

Tuross River.

No. 10.—♀, 1 lb.; 26 October, 1935, 12.30 p.m. Collected by Dr. Brown Craig. Coleoptera: 1 small Dytiscid beetle (*Necterosoma pencillata.*) Trichoptera: 2 Caddis cases (stick), 1 Caddis case (sand). Hymenoptera: 1 winged Ant (? gen. et sp.). Miscellaneous: Quantity of gravel.

No. 11.—♀, 3 lb.; 26 October, 1935, 1 p.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 Staphylinid beetle (*Cafius areolatus*), 2 *Heteronyx* sp., 1 *Cisseis* sp. (Buprestidæ), 1 Elaterid (? gen. et sp.), 1 small Carab beetle (? gen. et sp.). Trichoptera: 3 Caddis cases (sand). Hemiptera: 1 Tree-hopper (*Eurymeloides* sp.). Orthoptera: 1 Grasshopper (*Paratettix* sp.). Hymenoptera: 11 winged Ants (? *Iridomyrmex* sp.).

No. 12.—♀, 1 lb.; 26 October, 1935, 1.15 p.m. Collected by Mr. J. B. Craig. Trichoptera: 6 Caddis cases (sand), 1 Caddis case (stick). Ephemeroptera: 1 Mayfly nymph. Hymenoptera: 1 winged Ant (? gen. et sp.). Amphibia: Remains of a tadpole. Miscellaneous: Quantity of sand and gravel.

No. 13.—? sex, 1¼ lb.; 30 October, 1935, 12 (noon). Collected by Mr. J. B. Craig. Trichoptera: 6 Caddis cases (sand), 3 Caddis cases (stick). Ephemeroptera: 1 Mayfly nymph. Diptera: 22 Mycetophyllid midges. Hymenoptera: 1 Ant (*Iridomyrmex detectus*). Miscellaneous: Quantity of mud.

No. 14.—♀, 1 lb.; 30 October, 1935, 3 p.m. Collected by Mr. J. B. Craig. Coleoptera: Remains of 2 beetles (unidentifiable). Trichoptera: 15 Caddis cases (leaf). Vegetable matter: Quantity of remains.

No. 15.—♀, 3¾ lb.; 30 October, 1935, 4 p.m. Collected by Mr. J. B. Craig. Trichoptera: 1 Caddis case (stick). Crustacea: Claw of Yabbie (*Parachœraps bicarinatus*). Amphibia: 1 Frog, 1 Tadpole.

No. 16.—♀, 1¼ lb.; 1 November, 1935, 11 a.m. Collected by Mr. A. C. Ebsworth. Coleoptera: 1 Coleopterous larva. Ephemeroptera: 1 Mayfly nymph. Diptera: 1 Chironomid larva. Amphibia: Remains of tadpoles. Miscellaneous: Quantity of quartz gravel.

No. 17.—♂, 3 lb.; 1 November, 1935, 1 p.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 *Xyloryctus eucalypti*, 8 *Heteronyx* sp., 1 *Paropsis* sp., 2 small Carab beetles (? gen. et sp.), 3 Elateridæ (? gen. et sp.), 1 Cistelid beetle (? gen. et sp.), 1 Coleopterous larva. Trichoptera: 8 Caddis cases (stick), 2 Caddis cases (sand), 1 Caddisfly (imago). Hemiptera: 1 Pentatomid bug (? gen. et sp.), 1 Pentatomid bug—small (? gen. et sp.). Hymenoptera: 1 Ichneumon wasp (? gen. et sp.). Orthoptera: 1 Grasshopper (*Paratettix* sp.). Isoptera: Quantity of Termite wings. Miscellaneous insects: Quantity of remains.

No. 18.—? sex, 1¼ lb.; 1 November, 1935, 5 p.m. Collected by Dr. Brown Craig. Coleoptera: 1 *Heteronyx* sp., 1 *Paropsis* sp. Hemiptera: 1 Tree-hopper (? gen. et sp.). Hymenoptera: 1 Hive Bee (*Apis mellifera*). Isoptera: 96 winged Termites (*Coptotermes* sp.), and a very great quantity of wings. Miscellanous: Large quantity of quartz gravel.

No. 19.—? sex, ? weight; 1 November, 1935, 4 p.m. Collected by Dr. A. J. Spiller Brandon: Trichoptera: 12 Caddis cases (sand), 4 Caddis cases (stick). Ephemeroptera: 3 Mayfly nymphs. Isoptera: 3 winged Termites (*Coptotermes*) and quantity of wings. Miscellaneous insects: Quantity of broken remains.

No. 20.—? sex, 1¼ lb.; 2 November, 1935, 11.30 a.m. Collected by Mr. J. B. Craig. Coleoptera: 1 small Cistelid beetle (? gen. et sp.). Trichoptera: 10 Caddis cases (stick), 12 Caddis cases (sand). Ephemeroptera: 28 Mayfly nymphs. Miscellaneous insects: Small quantity of remains. Vermes: 1 Gordian worm. Amphibia: 1 Frog.

No. 21.—♀, 1 lb.; 3 November, 1935, 12.15 p.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: Remains of beetle (unidentifiable), 2 Soldier beetles (*Telephorus pulchellus*), remains of Elaterid (? gen. et sp.). Trichoptera: 3 Caddis cases (stick). Ephemeroptera: 15 Mayflies (imagines). Lepidoptera: 2 small moths (? gen. et sp.). Odonata: 1 Zygopterid nymph. Hemiptera: 1 Pentatomid bug (? gen. et sp.), 1 *Eurymeloides* sp. Hymenoptera: 1 Thynnid wasp (♀).

No. 22.—♀, 1¼ lb.; 3 November, 1935, 5 p.m. Collected by Mr. J. B. Craig. Ephemeroptera: 5 Mayfly nymphs. Vegetable matter: Stomach crammed with coarse vegetable matter. Miscellaneous: Large quantity of quartz gravel.

No. 23.—♀, 1¼ lb.; 5 November, 1935, 1 p.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 Hispid bettle (? gen. et sp.). Trichoptera: 3 Caddis cases (stick), 2 Caddis cases (sand), 1 Caddisfly. Diptera: 1 Stratiomyiid fly (*Odontomyia* sp.). Amphibia: 1 Frog, 1 Tadpole.

No. 24.—♀, 1¼ lb.; 5 November, 1935, 11 a.m. Collected by Dr. A. J. Spiller Brandon. Trichoptera: 7 Caddis cases (stick), 7 Caddis cases (sand). Ephemeroptera: 1 Mayfly nymph. Lepidoptera: 1 Lepidopterous larva. Miscellaneous insects: Small quantity of remains.

No. 25.—♀, 1 lb.; 7 November, 1935, 11.30 a.m. Collected by Mr. J. B. Craig. Trichoptera: 10 Caddis cases (sand), 2 Caddis cases (stick). Ephemeroptera: 2 Mayfly nymphs, 1 Mayfly (imago). Lepidoptera: 1 large Lepidopterous larva. Miscellanous insects: Quantity of unidentifiable remains. Crustacea: 2 Shrimps (*Paratya australiensis*). Vegetable matter: Seed-vessel of a Eucalypt and quantity of vegetable matter.

No. 26.—♀, 2 lb.; 7 November, 1935, 12.30 p.m. Collected by Mr. A. C. Ebsworth. Coleoptera: 1 *Heteronyx* sp., 1 Elaterid (? gen. et sp.). Trichoptera: 1 Caddis case (sand). Ephemeroptera: 2 Mayflies. Odonata: 2 Zygopterid dragonflies (imagines). Hemiptera: 2 Psyllids (Psyllidæ). Diptera: 2 Stratiomyiid flies (♂ and ♀) (? gen. et sp), 1 Blowfly (? gen. et sp.), 1 Mycetophyllid midge. Hymenoptera: 9 Thynnid wasps (8 ♂, 1 ♀) (? gen. et spp.), 1 Bee (? gen. et sp.), 1 winged Ant (? gen. et sp.). Miscellaneous insects: Quantity of broken remains. Arachnida: 1 Spider (? *Araneus* sp.). Miscellaneous: Several feathers.

No. 27.—♂, 3 lb.; 22 December, 1935, 11.30 a.m. Collected by Mr. W. H. Ifould. Coleoptera: 1 small Dytiscid beetle (*Necterosoma penicillata*), 1 *Paropsis* sp. Odonata: 22 Anisopterid nymphs.

No. 28.—♀, 1¼ lb.; 22 December, 1935, 4 p.m. Collected by Mr. W. H. Ifould. Coleoptera: 1 *Heteronyx* sp. Trichoptera: 4 Caddis cases (sand). Ephemeroptera: 2 Mayflies. Hemiptera: 1 *Corixa* sp. Perlaria: 1 Stonefly (? gen. et sp.). Hymenoptera: 2 Ichneumon wasps (? gen. et sp.). Miscellaneous insects: Small quantity of broken remains. Arachnida: 1 Spider (*Tetragnatha* sp.).

No. 29.—♀, 1½ lb.; 23 December, 1935, 11 a.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 Elaterid (? gen. et sp.). Trichoptera: 7 Caddis cases (sand). Odonata: 1 Zygopterid dragonfly (imago). Diptera: 1 Crane fly (? gen. et sp.). Hemiptera: 1 *Corixa* sp. Arachnida: Legs of spider.

No. 30.—♀, 1 lb.; 23 December, 1935, 1 p.m.—Collected by Mr. W. H. Ifould. Coleoptera: 1 *Diphucephala* sp. Trichoptera: 4 Caddis cases (stick). Ephemeroptera: 2 Mayflies. Odonata: 1 Anisopterid dragonfly (imago). Hymenoptera: 1 Ichneumon wasp (? gen. et sp.).

No. 31.—♀, 4¼ lb.; 24 December, 1935, 10 a.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 26 large *Heteronyx* sp. Ephemeroptera: 1 Mayfly. Crustacea: 1 Yabbie (*Parachæraps bicarinatus*).

No. 32.—♀, 1¾ lb.; 24 December, 1935, 1 p.m. Collected by Mr. W. H. Ifould. Coleoptera: 14 *Heteronyx* sp., 8 *Phyllotocus navicularis*, 2 Elateridæ (? gen. et sp.), 1 Longicorn (unidentifiable). Trichoptera: 7 Caddis cases (sand). Odonata: 2 Zygopterous dragonflies (♂♂), 1 Zygopterid nymph. Hymenoptera: 1 Thynnid wasp (♂) (? gen. et sp.), 8 Bees (*Hylæus* sp.). Miscellanous insects: Quantity of remains. Myriapoda: 15 Millepedes (? gen. et sp.).

No. 33.—♀, 1½ lb.; 26 December, 1935, 7 p.m. Collected by Mr. W. H. Ifould. Trichoptera: 5 Caddis cases (sand), 2 Caddis cases (stick). Vermes: 1 Planarian worm (? gen. et sp.).

No. 34.—♀, 1½ lb.; 28 December, 1935, 2.30 p.m. Collected by Mr. W. H. Ifould. Coleoptera: 1 Tenebrionid beetle (? gen. et sp.). Trichoptera: 267 Caddis cases (sand). Odonata: Wings of Anisopterid dragonflies, 1 Anisopterid nymph. Miscellaneous insects: Quantity of finely divided remains.

No. 35.—♀, 1½ lb.; 28 December, 1935, 11 a.m. Collected by Mr. W. H. Ifould. Coleoptera: 3 *Anoplognathus porosus*, 3 Click beetles (Elateridæ—? gen. et sp.), 1 *Heteronyx* sp., 2 *Diphucephala* sp., 23 *Phyllotocus navicularis*, large quantity of Coleopterous remains. Odonata: 1 Zygopterid nymph. Lepidoptera: 1 Lepidopterous larva. Hymenoptera: 1 Bee (*Hylæus* sp.), 1 Ichneumon wasp (? gen. et sp.), 1 Thynnid wasp (♀) (? gen. et sp.).

No. 36.—♂, 1½ lb.; 28 December, 1935, 3 p.m. Collected by Mr. W. H. Ifould. Coleoptera: 1 Weevil (*Orthorrhinus cylindrirostris*). Trichoptera: 1 Caddis case (sand).

No. 37.—♀, 1 lb.; 29 December, 1935, 6.30 p.m. Collected by Mr. W. H. Ifould. Coleoptera: 1 Click beetle (Elateridæ—? gen. et sp.), 3 *Heteronyx* sp. Trichoptera: 46 Caddis cases (sand), 3 Caddis cases (stick). Hemiptera: 1 *Gerris* sp. Miscellaneous insects: Small quantity broken remains.

No. 38.—♀, 2 lb.; 29 December, 1935, 11.30 a.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 *Anoplognathus porosus*, remains of large Scarabæid beetle (unidentifiable), 1 Soldier beetle (*Telephorus pulchellus*). Trichoptera: 5 Caddis cases (sand). Odonata: 4 Zygopterid nymphs, wings of Zygopterid dragonflies. Arachnida: 1 Spider (*Lycosa* sp.). Crustacea: 1 large Yabbie (*Parachæraps bicarinatus*).

No. 39.—♀, 2 lb.; 30 December, 1935, 12.30 p.m. Collected by Mr. W. H. Ifould. Coleoptera: 3 Elateridæ (? gen. et spp.), 1 *Heteronyx* sp., 1 *Heteronychus eucalypti*. Trichoptera: 10 Caddis cases (sand). Arachnida: Legs of spider (*Isopeda* sp.).

No. 40.—♀, 2 lb.; 30 December, 1935, 11 a.m. Collected by Mr. W. H. Ifould. Coleoptera: 3 *Phyllotocus macleayi*, 5 *Heteronyx* sp., 2 *Anoplognathus porosus*. Trichoptera: 2 Caddis cases (stick). Odonata: 2 Anisopterid dragonflies (imagines). Hemiptera: 1 *Corixa* sp. Miscellaneous insects: Large quantity of broken remains, mostly Coleoptera (Scarabæidæ).

No. 41.—♀, 1¼ lb.; 2 January, 1936, 3 p.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 Elaterid (? gen. et sp.), 3 *Heteronyx* sp. Trichoptera: 180 Caddis cases (sand), 3 Caddis cases (stick). Hymenoptera: 1 Thynnid wasp (*Hemithynnus variabilis*) (♂).

No. 42.—? sex, 1½ lb.; 2 January, 1936, 7.30 p.m. Collected by Mr. W. H. Ifould. Coleoptera: 1 *Anoplognathus porosus*. Trichoptera: 6 Caddis cases (sand), 1 Caddis case (stick). Arachnida: 2 Spiders (*Araneus* sp.). Crustacea: 1 small Yabbie (*Parachæraps bicarinatus*). Amphibia: 1 Frog.

No. 43.—? sex, 1 lb.; 2 January, 1936, 3.30 p.m. Collected by Mr. W. H. Ifould. Coleoptera: 1 Chrysomelid beetle (? gen. et sp.), 1 Tenebrionid beetle (? gen. et sp.), remains of *Anoplognathus* ? *porosus*. Hemiptera: 1 *Corixa* sp. Hymenoptera: 1 Thynnid wasp (♂) (? gen. et sp.), 2 small Sawflies (Tenthredinidæ—? gen. et sp.).

No. 44.—? sex, 1 lb.; 2 January, 1936, 8 a.m. Collected by Mr. W. H. Ifould. Coleoptera: 11 Scarabæid beetles (*Heteronyx* sp.).

No. 45.—♂, 2 lb. 2 oz.; 6 January, 1936, 12.30 p.m. Collected by Mr. J. Harnett. Coleoptera: 1 *Anoplognathus porosus*. Odonata: 1 Zygopterid nymph, 1 Zygopterid imago. Hemiptera: 1 Pentatomid bug (? gen. et sp.). Crustacea: 1 large Yabbie (*Parachæraps bicarinatus*).

No. 46.—♀, 1 lb.; 11 January, 1936, 1 p.m. Collected by Mr. J. Harnett. Coleoptera: 5 *Anoplognathus porosus*, 1 *Phyllotocus* sp., 1 *Heteronyx* sp. Diptera: 1 Syrphid fly (? gen. et sp.). Hemiptera: 1 *Eurymeloides* sp.

No. 47.—♀, 13 oz.; 17 January, 1936, 6 p.m. Collected by Mr. J. Harnett. Coleoptera: 1 *Phyllotocus* sp., 1 *Heteronyx* sp. Trichoptera: 210 Caddis cases (sand). Hymenoptera: 1 Thynnid wasp (? gen. et sp.), 2 Ants (*Myrmecia* sp.), 1 Bee (? gen. et sp.). Miscellaneous insects: Quantity of insect remains.

No. 48.—♀, ¾ lb.; 18 January, 1936, 11 a.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 30 small Scarabæid beetles (? gen. et sp.), 4 *Anoplognathus porosus*. Odonata: 1 large Anisopterid dragonfly (? gen. et sp.). Hymenoptera: 1 Thynnid wasp (♂).

No. 49.—♀, 1 lb. 2 oz.; 18 January, 1936, 12.30 p.m. Collected by Mr. J. Harnett. Coleoptera: 4 *Anoplognathus porosus*, 1 *Heteronyx* sp., 2 *Diphucephala* sp., 1 *Lagria* sp., 1 Dung beetle (*Onthophagus granicollis*), 14 *Phyllotocus* sp., 1 Ladybird beetle (*Leis conformis*). Diptera: 1 Apiocerid fly (? gen. et sp.). Hymenoptera: 2 Wasps (? gen. et sp.). Arachnida: 1 Spider (*Araneus* sp.).

No. 50.—♀, ¾ lb.; 19 January, 1936. 11 a.m. Collected by Mr. J. Harnett. Coleoptera: 1 *Anoplognathus porosus*), 1 Elaterid beetle (? gen. et sp.), 1 Dung beetle (*Onthophagus granicollis*), 1 *Diphucephala* sp. Trichoptera: 1 Caddis case (sand). Diptera: 1 Fly (*Rutilia* sp.). Hemiptera: 1 *Gerris* sp. Hymenoptera: 1 Thynnid wasp (♂), 4 winged Ants (*Iridomyrmex* sp.). Miscellaneous: 1 feather.

No. 51.—♀, 1 lb.; 19 January, 1936, 12.30 p.m. Collected by Mr. J. Harnett. Coleoptera: 2 Elaterid beetles (? gen. et sp.), 1 Clerid beetle (*Trogodendron* sp.). Trichoptera: 69 Caddis cases (sand). Hemiptera: 10 *Gerris* sp. Hymenoptera: 1 Thynnid wasp (? gen. et sp.), 1 Ant (*Myrmecia* sp.).

No. 52.—♀, ¾ lb.; 18 January, 1936, 5.30 p.m. Collected by Mr. J. Harnett. Coleoptera: 1 *Heteronyx* sp., 4 *Phyllotocus* sp., 1 *Anoplognathus porosus*. Trichoptera: 31 Caddis cases (sand), 2 Caddis cases (stick). Hemiptera: 1 Tree-hopper (*Eurymeloides* sp.). Hymenoptera: 3 Bees (*Halictus* sp.), 2 Thynnid wasps (♂♂).

No. 53.—♀, ½ lb.; 18 January, 1936, 6 p.m. Collected by Mr. J. Harnett. Coleoptera: 1 *Phyllotocus* sp. Trichoptera: 8 Caddis cases (sand).

No. 54.—♂, 2¼ lb.; 20 January, 1936, 11 a.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 *Anoplognathus porosus*, 4 Elaterid beetles (? gen. et sp.), 4 *Heteronyx* sp., 5 *Telura vitticollis*, 1 *Cryptocephalus* sp. Odonata: 1 Anisopterid nymph, 32 Zygopterid dragonflies (imagines).

No. 55.—♀, 1 lb.; 1 February, 1936, 11 a.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 *Anoplognathus porosus*, 9 *Paropsis* larvæ. Trichoptera: 2 Caddis cases (sand). Diptera: 9 Flies (*Musca vetusissima* or ? *domestica*).

No. 56.—♀, 1½ lb.; 3 February, 1936, 10 a.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 *Paropsis* sp., 1 *Heteronyx* sp. Trichoptera: 4 Caddis cases (sand). Ephemeroptera: 6 Mayflies.

No. 57.—♀, 1½ lb.; 8 February, 1936, 12.30 p.m. Collected by Dr. A. J. Spiller Brandon. Trichoptera: 160 Caddis cases (sand), 2 Caddis cases (stick). Odonata: 22 Zygopterid dragonflies (imagines). Hemiptera: 1 Reduviid bug (? gen. et sp.), 1 Pentatomid bug (? gen. et sp.). Vegetable matter: Leaves of tea-tree.

No. 58.—♀, 1½ lb.; 14 February, 1936, 5 p.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 *Paropsis* larva, 1 *Diphucephala* sp., 9 *Heteronyx* sp. Diptera: 57 Chironomid midges. Hemiptera: 2 Tree-hoppers (*Eurymeloides* sp.).

Hymenoptera: 1 Bee (*Halictus* sp.), 1 Sphecid wasp (? gen. et sp.), 2 large Thynnid wasps (♂ and ♀) (? gen. et sp.), 2 small Thynnid wasps (♂ and ♀) (? gen. et sp.), 1 Thynnid wasp (♂), 5 winged Ants (? gen. et sp.). Orthoptera: I immature Grasshopper. Isoptera: 1 winged Termite (*Coptotermes* sp.).

No. 59.—♂, 1¼ lb.; 15 February, 1936, 11 a.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 *Phyllotocus assimilis*, 1 *Paropsis* larva. Trichoptera: 6 Caddis cases (sand). Odonata: 2 Zygopterid nymphs. Diptera: 672 Chironomid midges. Hemiptera: 1 Pentatomid bug (? gen. et sp.). Orthoptera: 1 immature Grasshopper (long-horned).

No. 60.—♀, 1¾ lb.; 15 February, 1936, 10.30 a.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 *Paropsis* sp., 1 *Phyllotocus assimilis*, some Scarabæid remains. Trichoptera: 1 Caddis fly. Diptera: 1,057 Chironomid midges and stomach crammed with remains. Hemiptera: 6 Tree-hoppers (*Eurymeloides* sp.).

No. 61.—♀, 1 lb.; 15 February, 1936, 6 p.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 *Cryptocephala* sp., 1 *Cisseis* sp. (Buprestidæ), 1 *Diphucephala* sp. Trichoptera: 1 Caddis case (stick), 3 Caddis cases (sand). Ephemeroptera: 1 Mayfly and quantity of remains. Diptera: 37 Chironomid midges. Hymenoptera: 1 Bee (*Apis mellifera*), 1 Bee (*Hylæus* sp.), 6 winged Ants (? gen. et sp.), 2 Bees (*Halictus* sp.).

No. 62.—♀, 1 lb. 16 February, 1936, 1 p.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 Soldier beetle (*Telephorus pulchellus*), 1 *Diphucephala* sp., 1 *Heteronyx* sp., 1 Tenebrionid beetle (? gen. et sp.), 1 Gyrinid beetle (? gen. et sp.). Trichoptera: 4 Caddis cases (sand), 1 Caddis case (stick). Odonata: 8 Zygopterid nymphs. Diptera: 1 *Bibio* sp. Hemiptera: 2 Tree-hoppers (*Eurymeloides* sp.).

No. 63.—♂, 2 lb.; 17 February, 1936, 11 a.m. Collected by Mr. V. Richards. Coleoptera: 1 Scarabæid beetle (*Telura vitticollis*). Odonata: Wings of Anisopterid dragonflies. Hemiptera: 1 *Gerris* sp.

No. 64.—♀, 1 lb.; 17 February, 1936, 11.30 a.m. Collected by Mr. V. Richards. Coleoptera: 1 Scarabæid beetle (*Telura vitticollis*), 1 *Cryptocephala* sp., 2 Ladybird beetles (*Rhizobius* sp.). Orthoptera: 1 immature Grasshopper. Miscellaneous insects: Stomach crammed with minute fragments of midges and winged ants.

No. 65.—♀, 1 lb.; 17 February, 1936, 12 (noon). Collected by Mr. V. Richards. Coleoptera: 1 *Anoplognathus porosus*, 1 *Cryptocephala* sp. Odonata: Wings of Zygopterid dragonflies. Vermes: 1 Planarian worm.

No. 66.—♂, 2½ lb.; 18 February, 1936, 10 a.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 2 *Paropsis* larvæ, 6 *Heteronyx* sp., 1 *Cisseis* sp., 1 Elaterid (? gen. et sp.), 5 *Telura vitticollis*, 1 *Diphucephala* sp., 1 *Phyllotocus assimilis*. Odonata: 1 Anisopterid nymph. Diptera: 706 Chironomid midges, 1 Stratiomyiid fly (*Odontomyia* sp.), 2 Stratiomyiid flies (*Odontomyia*). Lepidoptera: 1 large moth. Hymenoptera: 1 Thynnid wasp (♂). Hemiptera: 2 Tree-hoppers (*Eurymeloides* sp.), 1 Tree-hopper (? gen. et sp.). Amphibia: 1 Frog.

No. 67.—♀, 1½ lb.; 23 February, 1936, 5 p.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 Elaterid (? gen. et sp.), 1 Soldier beetle (*Telephorus pulchellus*), 4 *Cryptocephala* sp. Diptera: 1 Syrphid fly (? gen. et sp.), 27 Chironomid midges and quantity of remains. Hemiptera: 22 *Gerris* sp., and quantity of remains, 4 Rutherglen bugs (*Nysius vinitor*), 2 Tree-hoppers (? gen. et sp.). Thysanoptera: 15 *Idolothrips spectrum* and quantity of remains.

No. 68.—♀, 1¾ lb.; 25 February, 1936, 10 a.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 1 Longicorn beetle (*Macrones rufus*), 8 *Heteronyx* sp., 1 *Stigmodera* sp. (Buprestidæ), 2 Scarabæid beetles (? gen. et sp.), 1 *Paropsis* sp. Diptera: 23 Chironomid midges.

No. 69.—♂, 2½ lb.; 25 February, 1936, 11 a.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 47 *Phyllotocus assimilis*, 4 *Heteronyx* sp., 1 *Notodascyllus* sp., 2 *Paropsis* sp. Diptera: 2 Stratiomyiid larvæ (? *Odontomyia*), 37 Chironomid larvæ. Hemiptera: 4 Tree-hoppers (*Eurymeloides* sp.). Miscellaneous insects: Large quantity of insect remains.

No. 70.—♀, 1½ lb.; 25 February, 1936, 11.30 a.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 14 *Heteronyx* sp., 14 *Phyllotocus assimilis*, 2 Scarabæid beetles (*Teleura vitticollis*). Trichoptera: 1 Caddis case (stick). Odonata: 1 Zygopterid dragonfly (imago). Diptera: 13 Chironomid midges. Hemiptera: 2 Tree-hoppers (*Eurymeloides* sp.), 5 *Gerris* sp. Orthoptera: 1 Cricket (? gen. et sp.). Miscellaneous insects: Quantity of insect remains.

No. 71.—♀, 1 lb.; 29 February, 1936, 11.30 a.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 4 Gyrinid beetles (? gen. et sp.). Trichoptera: 84 Caddis cases (sand), 15 Caddis cases (stick). Diptera: 6 Chironomid midges. Hymenoptera: 1 Bee (*Apis mellifera*) (♂), 1 Bee (? gen. et sp.). Hemiptera: 2 *Gerris* sp. Arachnida: 1 Spider (? gen. et sp.).

No. 72.—♀, 2 lb.; 29 February, 1936, 5 p.m. Collected by Dr. A. J. Spiller Brandon. Coleoptera: 3 *Anoplognathus* sp., 2 *Paropsis* larvæ. Trichoptera: 113 Caddis Cases (sand), 6 Caddis cases (stick). Odonata: 1 Zygopterid dragonfly (imago). Diptera: 1 Blowfly (*Lucilia* sp.), 157 Chironomid midges, 2 Crane-flies (Tipulidæ—? gen. et sp.). Hemiptera: 25 Tree-hoppers (*Eurymeloides* sp.), 1 Pentatomid bug (? gen. et sp.). Hymenoptera: 4 Bees (*Apis mellifera*), 2 Ants (*Iridomyrmex detectus*). Miscellaneous insects: Large quantity of finely broken remains. Vegetable matter: Quantity of vegetable remains, tea-tree, leaves, etc.

Summary of Food of Brown Trout, Tuross River.

Stomachs examined	64
Coleoptera	435
Trichoptera	1,501
Ephemeroptera	72
Lepidoptera	5
Hemiptera	108
Hymenoptera	97
Diptera	2,043
Odonata	108
Orthoptera	6
Isoptera	100
Arachnida	9
Myriapoda	15
Vermes	3
Crustacea	6
Amphibia	8

THE IDENTITY OF COOK'S KANGAROO.

By

Tom Iredale and E. Le G. Troughton.

In a joint paper concerning "Captain Cook's Kangaroo", in the "Australian Zoologist" for 1925, original accounts were quoted to emphasize the fact that, contrary to popular belief, and subsequent writings which maintained the fallacy, Cook's party did not observe the actual animal at Botany Bay. It was also demonstrated conclusively that the Great Grey Kangaroo (*Macropus major* Shaw, 1800), hitherto generally listed as *Macropus giganteus*, is not identical with the small species of kangaroo first observed by Cook and his party at Cooktown.

The ineligible generic names of *Jaculus* and *Jerboa* were applied to Cook's animal in 1777 in reference to the outward resemblance to the small rodent jerboas of other lands, together with the specific names of *giganteus* and *gigantea*, respectively by Erxleben and Zimmermann, because of its gigantic size in comparison with them. It was indicated, however, by the present authors in the Check-list of Mammals[1], that the name *giganteus* for Cook's species was also antedated by that of *cangaru*, applied by Müller in 1776 in the Systema Naturæ of Linné, based upon the original written versions of the name used by the aborigines.

In our first paper it was found impossible to indicate the definite identity of Cook's kangaroo because of the lack of topotypical representatives of the several species of macropods known to occur in the Cooktown area, and the seeming inconsistencies in the hunters' and naturalists' descriptions. Analysis of a copy of Solander's MS. Latin description which Iredale had procured, however, eliminated the medium-sized "Agile Wallaby" by its partially hairy rhinarium, sandy to yellowish coloration, and somewhat stocky build, and suggested that the animal might have been a small wallaroo.

The size given for the animal actually described, however, did not accord with that of a fully grown wallaroo, and a decision regarding its identity was deferred until skins and skulls of the various local species could be obtained for comparison. Fortunately, Iredale joined the British Museum Barrier Reef Expedition at Low Isles in 1929, and it was arranged that he should visit Cooktown and secure specimens if possible. As a result of his inquiries, skins and skulls of a wallaroo and whiptail wallaby were subsequently purchased, showing the wallaroo to be a richly coloured animal of the *antilopinus* type, and therefore in no way comparable with the "mouse" and "ash" coloured animal of the Cook accounts.

In a renewed effort to settle the identity of Cook's species, Troughton recently reviewed the characteristics of the whiptail in regard to the specimen from Cooktown and found them in general agreement with the original accounts, excepting that the incisors were not in accordance with our first interpretation of Solander's description. Further analysis of the debatable passage, however, makes it clear that the phrase which apparently referred only to the structure of the third incisor, actually constitutes a comparative reference to the combined anterior ones, in the light of which interpretation the description of the incisors proves to be quite typical, within the known variation, of these teeth in the whiptail wallaby.

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[1] Iredale and Troughton.—Check-list of the Mammals Recorded from Australia, Mem. Austr. Mus., vi, 1934, p. 55.

In addition to the incisors, other salient points of agreement between the first accounts and the whiptail are the slender form and long tapering tail, which equals the body length, long ears, and especially the rhinarium, which is entirely hairless and black, with a mosaic scale-pattern. The general coloration of the Cooktown skin, which is less contrasted than in typical southern examples, agrees also with the original accounts, which variously note "mouse colour", "dark mouse or grey colour", "ash-coloured", and "cinereus" in Solander's description, for the general colour. Allowance must of course be made for individual and seasonal variation such as shown in a series of southern examples, and for the fact that "dark mouse colour" would imply the presence of the dusky brown commonly seen in rodents, while the colour value of "cinereus" was differently understood in the past.

Regarding the marked discrepancy in weight given for the first and last of the three animals reported as captured by Cook's party, a study of the various accounts shows that Solander's description, and other details, refer only to the first male taken on July 14th, with the head and body 28 in. and the tail 26 in. in length, and a total weight of 38 lb. The measurements afford a total length of 1,372 mm. which accords quite well with that of southern animals of similar age, especially in view of indications that the Cooktown form is of smaller average size. In this regard, the weight is in full accordance with the mean values of 49 and 32 lb., for two males and two females respectively, given by Finlayson[2] from the Dawson Valley, Queensland.

Concerning the relative weight of various species of *Wallabia*, Finlayson noted of the whiptail that "its body weight is probably low in comparison with its linear dimensions", and that even in old males the slimness of the forequarters remains. Although old males frequently attain to comparatively exceptional size, as in all members of the kangaroo family, it seems evident that the large 84 lb. animal killed by Cook's party a fortnight later, over twice the weight of the first capture, and 35 lb. in excess of the maximum mean given for southern whiptails, must have represented a different species. The latter animal was most probably a young wallaroo, the bright coloration of which was overlooked in view of the general similarity in form of animals of such unique interest at the time. However, it is clear that the actual descriptive matter was based upon the small male first captured, a few points only being added from the intermediate small female, merely the weight and no other details being given for the last and much larger animal. The identity of the latter cannot therefore affect the conclusion that the small animal represented the first recording of the whiptail form of wallaby.

Regarding the habits and habitat of Cook's Whiptail, it is notable that the original illustration reproduced in our first paper shows the animal in the upright position characterisic of the species when disturbed while feeding, as well as the slender neck and shoulders, large ears, and attenuated tail recognized as characteristic of the whiptail, and commented upon in the original accounts. In reproducing the figure it was stated that a pencil drawing of the animal described by Parkinson, draughtsman on the Endeavour's voyage, was probably preserved in the British Museum, but since visiting Cooktown Iredale has confirmed the fact that the general surroundings in the illustration are so similar to those of Cooktown, pictured in the absence of habitation, as to indicate that the plate actually represents Parkinson's original drawing.

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[2] Finlayson.—Trans. Roy. Soc. South Austr., lv, 1931, pp. 75-8, pls. ii-iii.

The details of the illustration and accompanying accounts accord closely with Finlayson's general account of the whiptails of the Rockhampton area concerning their appearance, habits, and favoured habitat. The whiptails, he states, resemble the Toolache (*Wallabia greyi*) in spending most of their time in very open country, and are more easily approached and observed than any other wallaby in the district. It is also stated that the whiptail is regarded locally as an extremely fast wallaby, and that it is more diurnal than other brush wallabies, feeding out in the open up to 10 a.m. and after 4 p.m. except in extreme heat, while in winter it may be seen about all day. The undulating park-like uplands of the broad-leafed ironbarks are given as the typical whiptail habitat, richly grassed, with frequent low broken rocky out-crops which are free from bushy growth though at times bordered by it, and with the trees rather widely spaced. The significance of the point regarding the comparative ease in observing the species, and the similarity in detail of this data with the illustration and the first accounts are too obvious to warrant further comment.

On the possibility of survival of these beautiful wallabies, Finlayson provides reason for grave concern, because like so many open country mammals they evince a curiosity which earns them a reputation for stupidity amongst shooters and trappers, who state that in winter when large mobs gather on the sunny sides of ridges a dozen may be shot before the others move off, providing the shooter does not change position. The instinct for self-preservation from man is said to be almost nil, and makes destruction, encouraged by its attractive coloration and habits, tragically simple, so that although they are fairly numerous over a large area in suitable tracts, Finlayson, knowing the fate of open country species elsewhere, formed the opinion that the whiptail could not survive the present rate of slaughter in the cattle country of the Dawson River.

As he points out, probably the many thousands of wallabies killed each year in coastal Queensland do not merely represent the normal increase, as interested parties are apt to assume, but the natural concentration from large and relatively poor feeding areas to smaller and more attractive ones supporting denser populations. Thus with settlement, these "fur pockets" act as natural traps, and the resultant slaughter, which is apparently local, actually affects vast areas of the species' original range. It is this factor of concentration which is emphasized as being mainly responsible for the unexpected suddenness which has marked the fading or extinction of many fascinating and more observable marsupials, since the discovery of Australia.

Although it was gratifying to find that a specimen of Cook's species could be secured within twelve miles of Cooktown in 1929, one wonders how long this delightful and historically interesting species will survive in the restricted area of Cape York Peninsula with increased settlement following upon the opening of the proposed road through from Cairns. Surely no more potent plea for the protection and conservation of native fauna, by provision of suitable reserves, could be placed before scientific and governmental authorities than the risk of extermination of such beautiful creatures, the first of their kind observed with such interest by Captain Cook's party on the vast eastern coast of Australia.

In concluding this general review, it may be noted that, having accounted for the apparent discrepancy in regard to the incisors and the extreme size of one of the animals, and considering the general points of similarity, we have no reasonable doubt that the Cape York representative of the well known whiptail wallaby is identical with the original animal described by members of Cook's party and known to them by the aboriginal name of "kangooroo" or "kanguru". The whiptail wallaby of the far north should therefore be known as *Wallabia cangaru*, as the name *giganteus* of Erxleben is antedated by Müller's specific designation.

As Cook's animal is shown to be a large wallaby, or medium-sized kangaroo, and the name *giganteus* was based on a comparison with the true jerboas which, as Banks stated, would be "no larger than a common rat", rejection of the name for the Great Grey Kangaroo is not to be regretted, especially as the valid and equally appropriate one of *major* is available for that fine species of large kangaroo.

Owing to popular supposition that only the largest members of the family are to be regarded as kangaroos, the difference between them and wallabies forms the subject of frequent inquiry at the Museum. Because of this, the scientific name of Captain Cook's Whiptail Wallaby, now established as *Wallabia cangaru*, is most appropriate as the generic and specific names link the aboriginal ones as an indication that no marked difference actually exists, while associating the primitive inhabitants with the landing of the "Endeavour" at Cooktown and the first observation of kangaroos on the coast of "New Holland".

Indeed, the change in nomenclature of long standing is unusually fortunate, based as it is upon the actual identity of the original species described during Captain Cook's visit, which has been the subject of mis-identification for over one hundred and sixty years. The interest and practical advantages attaching to the solution of the matter should overcome the usual sentimental objections to taxonomic change and prove, in this instance we hope, a source of satisfaction to historians as well as naturalists.

Captain Cook's Whiptail.

Wallabia cangaru Müller, 1776.

Mus cangaru Müller, Syst. Nat. (Linné), Suppl., 1776, p. 62.
Jaculus giganteus Erxleben, Syst. Anim., 1777, p. 409.
Jerboa gigantea Zimmermann, Spec. Zool., 1777, p. 526.
Didelphys gigantea Schreber, Säugthiere, iii, 1777, p. 552, pl. cliv.
Zerbua kangaru J. R. Forster, K. Vet. Ac. Handl., xxxix, 1778, p. 113.
Didelphis kenguru Zimmermann, Geogr. Gesch., ii, 1780, p. 231.
Mus caenguru Hoslin, Syst. Nat. (Linné), i, 1781, p. 125.

General Characters.—The above account has dealt with the agreement of the original descriptions with the general features accepted as characteristic of the whiptail wallaby, and it is now necessary to consider to what extent the southern animals differ from the Cape York one as typical of the first described form. Examination of a young adult topotypical skin and skull indicates that the main points are that the size and weight are consistent in suggesting that the size averages smaller; the ear is shorter and not definitely bi-coloured as in southern examples, the brown coloration extending to the tip and being merely grizzled with buff hairs on the edges and upper fourth.

Entire coloration less contrasted in tones, the light cheek mark narrower and less defined owing to being buffy instead of clear white, and the dark lower border is paler; limbs toning with the body, especially the forearms, which are buffy grey instead of whitish, and rump marks less defined. Fur of back shorter, less dense, and unicoloured save for the variegated tipping, there being no trace of contrasted light basal coloration. The rhinarium, not described for the southern form in the "Catalogue", entirely naked, the short hairing of the nose stopping at a line above the nostrils, instead of extending down half the distance between them, as figured in the "Catalogue" for *W. agilis*, the other member of the genus occurring at Cooktown.

The skull of the topotypical adult male supports the contention of relatively smaller size in that the dimensions barely equal those of a younger adult female from the south, and the general proportions are smaller, except in the slightly greater zygomatic width. The intertemporal constriction is 3·5 mm. narrower than in a southern female's skull of similar total length, thereby confirming its superior age, contrasted with the relatively smaller proportions, which are obvious but difficult to define with a single example for comparison. The dentition appears quite similar, any slight differences suggested in the third incisor and fourth premolar being negatived by the individual variability of these teeth.

Dimensions.—Measurements of the flat skin are not given, as stretching renders them misleading. The paws are unfortunately lacking. Ear-length 75 mm.

Skull of adult male: Greatest length 130; basal length 116·5; zygomatic breadth 65·5; nasals, length —, breadth 18·5; constriction 17·5; palate length 77·5; palatal foramina 7·3; basi-cranial axis 34·5; basi-facial axis 85; facial index 247; pm^4 5·7; $molars^{1-3}$ 24 mm.

Habitat.—The more open hilly country about Cooktown, Cape York Peninsula, North Queensland; topotype from within 12 miles of the town.

Remarks.—The restricted and more definitely coastal range of the Cape York whiptail is confirmed by a combination of distinctive features which it seems advisable for the present to regard as being of full specific value. The southern animal will therefore be distinguished by the very appropriate name of *elegans*, as already shown in our Check-list, instead of *parryi* as listed in the British Museum Catalogue.

Although Lambert's account of *elegans*, in the Transactions of the Linnean Society of London for 1807, was considered inadequate by Thomas, the description of the colour and dimensions, with the illustration, conclusively establishes its association with the southern form of whiptail wallaby. The coloration of "a beautiful silver-gray", and the name of "Silver" kangaroo, given by Lambert could not possibly refer, as Thomas suggested, to the *melanops* form of Great Grey Kangaroo or the Red-necked Wallaby, or to the sombre wallaroo of New South Wales, while agreeing completely with a well known colour phase of the whiptail wallaby.

APR. 1940

NATIONAL MUSEUM OF VICTORIA

PALÆONTOLOGICAL NOTES.

No. IV.*

By

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Director, The Australian Museum.

(Plates viii–x, and one map.)

Fossil Marsupials from New Guinea.

It is surprising that up to the present there is no record of the finding of fossil marsupials in the large island of New Guinea, which in its recent fauna presents a strong similarity to the Australian continent, a similarity which without doubt obtained also in the Pleistocene and earlier. The existence today of the cassowary, echidna, tree kangaroos, wallabies, and other marsupials on both sides of Torres Strait, indicates that at one time there was land communication between Australia and New Guinea, and it is natural to expect that some of the extinct forms which are of common occurrence in Australia would also be found in the neighbouring island. That they have not previously been recognized there is probably due to the fact that until recently there were no mining, quarrying, or other operations in New Guinea, activities which often result in the discovery of fossil bones.

It was, therefore, with great interest that some fossil bones from the Morobe district, Territory of New Guinea, recently received at the Museum, were examined, particularly when it became apparent that they presented a close resemblance to specimens which are commonly found in Australian superficial deposits of Post-Tertiary age.

These interesting specimens were first brought to our notice by Mr. G. A. V. Stanley, B.Sc., a geologist on the staff of Oil Search Ltd., who had observed a jaw bone, since determined as that of a *Nototherium*, in the office of the Geological Survey at Wau. This specimen, consisting of two mandibular rami, was forwarded to the Museum by Mr. N. H. Fisher, Government Geologist, Territory of New Guinea, who subsequently visited the spot where it was found and examined the occurrence. Mr. Fisher was also fortunate enough to obtain additional material consisting of some fragmentary macropod bones, which he also sent to the Museum. While on furlough in Sydney Mr. Fisher kindly gave me some particulars of the mode of occurrence and also supplied a map from which a sketch map of the district has been prepared.

Occurrence.

The nototherian mandible was found on the Waiganda or Roaring Creek, a tributary of the Watut River. This river junctions lower down with the Bulolo

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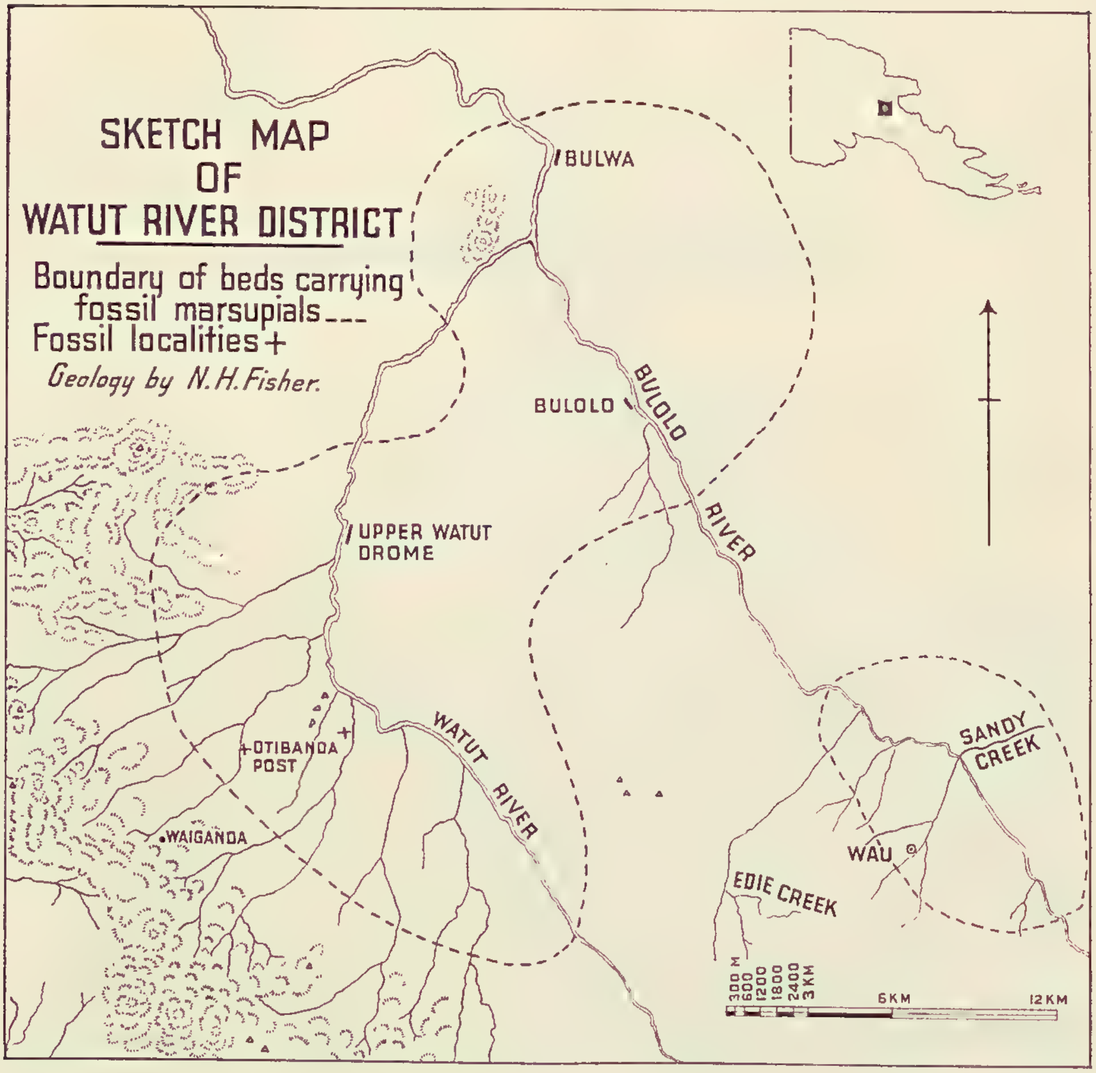
* For No. III, see Records of the Australian Museum, Vol. xviii, No. 7, June, 1932, p. 383.



and flows into the Markham, which empties into the sea at the head of the Huon Gulf. The other specimens were found at a distance of about two miles on Iroa Creek, which also flows into the Watut. In each case the specimens were discovered in lacustrine beds, which are definitely older than the overlying alluvial deposits (river flats and terraces). These freshwater beds consist of sandstones, shales, and mudstones, mostly fine grained, but with occasional bands of conglomerate, the pebbles of which are seldom more than a few inches in diameter. Beds of a volcanic agglomerate are included in this freshwater series, the strata of which are only slightly tilted and show signs of tranquil deposition. They contain some plant remains, consisting of leaves in fairly good preservation.

This lacustrine deposit is about twenty miles in maximum length and about eight or nine miles wide in places, but is not continuous, there being two main areas, one on the lower Bulolo and Watut Rivers, the other on the upper Bulolo area. Its approximate extent is shown on the accompanying map.

In both cases the discovery was the result of the construction of water races connected with sluicing operations, and the bones were found at shallow depths; the Roaring Creek find was made at a depth of about six feet from the top of the freshwater beds (there is an overburden of about three or four feet of soil); the bones on Iroa Creek were found at depths varying from two to six feet.

Nototherium watutense, sp. nov.

(Plate viii.)

The most interesting of the specimens are the two mandibular rami, which from their similarity in size and appearance are in all probability the right and left halves belonging to the same individual. Unfortunately, both are fragmentary, but they retain diagnostic features which leave little doubt that they belong to an undescribed species of *Nototherium* (*sensu lato*), to which the name *N. watutense* is assigned. They are considerably smaller than the corresponding bones of any known species of the genus, yet the solitary tooth (part of a fourth molar) which is preserved indicates by its wear that the animal was adult.

The left half of the mandible (Reg. No. F.36311; Pl. viii), so far as preserved, consists of a segment 167 mm. in length, beginning slightly in advance of the third molar (of which the posterior root is *in situ*) to a little behind the posterior opening of the dental canal, which is practically on the level of the alveolar surface of the mandible. The inflected angle is broken, but sufficient remains to indicate its general character. It begins slightly in front of the anterior lobe of m_4, forming a short shelf which almost disappears about 20 mm. behind the posterior lobe of m_4. The shelf widens again about 25 mm. in front of the orifice of the dental canal, which is situated in the angle between the ascending ramus and the platform forming the continuation of the alveolar surface (Pl. viii, O). The posterior lobe of m_4 is preserved, but the medial portion is fractured. The tooth shows considerable wear, the dentine being well exposed on the crown of the lobe; the enamel is highly polished and has a slightly bluish tinge.

The following comparative measurements have been obtained:

	A.	B.	C.	D.	E.	F.
Depth at hind lobe m_4	54·5	74·0	74·5	—	84·0	—
Thickness below m_4	46·0	62·0	65·0	—	53·0	—
Front of dental canal orifice to m_4 (exclusive)	46·5	58·0	—	—	—	83·0
Length m_4	31·0	46·0	48·0	37·0	38·0	—
Breadth m_4 (anterior lobe) ..	17·0	34·5	32·0	22·0	25·0	—

A = *Nototherium watutense*. Austr. Mus., F.36311.
B = *N. victoriæ* Owen. Cast of type.
C = *N. mitchelli* Owen. Austr. Mus., F.4626 (*Brit. Mus. Cat. Foss. Mamm.*, Pt. v, 1887, No. 43088, p. 164).
D = *Owenia* (= *Euowenia*) *grata* De Vis. *Proc. Roy. Soc. Queensland*, iv, 1887, p. 99 (*fide* H. A. Longman).
E = "Zygomaturus" De Vis. *Proc. Roy. Soc. Queensland*, xi, 1895, p. 6 (*fide* H. A. Longman).
F = *N. tasmanicum* Scott. *Tas. Geol. Surv. Rec.* No. 4, 1915, p. 10.

These measurements indicate that our specimen is the smallest member of its family yet described, the only one approaching it in this respect being *Euowenia grata* De Vis. The main distinguishing feature of that genus, however, is the fact that it has but two upper incisors, and I therefore prefer to leave the Watut River form in *Nototherium* (*sensu lato*), pending the discovery of maxillary specimens. The "Zygomaturus" jaw described by De Vis has molars of relatively small size, but the mandible itself is much more massive than ours.

But little can be said of the affinities of *Nototherium watutense* on account of the scantiness of the material, but the position of the posterior orifice of the dental canal links it with *N. victoriæ* and *Euowenia grata* ("posterior dental foramen level with the worn surface of the last molar") rather than with *N. mitchelli* and *N. tasmanicum.*

The age of the Watut River specimen is uncertain; Mr. Fisher is of opinion that the freshwater beds in which it was found are Pleistocene (overlying Tertiary volcanics) or very late Tertiary. It is possible that *N. watutense* is slightly older than its Australian congeners, which are found in superficial unconsolidated deposits, such as river terraces, flood plains, swamps, and cave earth, not, as in New Guinea, in consolidated beds distinctly underlying alluvial material.

As regards the significance of its occurrence, apart from the proof it affords that this distinctive family, which is so widely spread in the Australian Pleistocene, also extended to New Guinea, its small size suggests the possibility that it was a member of a more primitive assemblage of animals than that which characterized the Australian Pleistocene, and that it is an outlying representative of a slightly older fauna which may yet be found in the Australian Tertiary. This does not mean, however, that Australian Pleistocene marsupials originated in New Guinea, for there can be little doubt that *Nototherium* and its contemporaries evolved on the Australian continent.

Type.—Left mandibular ramus with part of m_4, No. F.36311. Associated right ramus, F.36312. In the Australian Museum collection.

Macropod Bones.

The bones found on Iroa Creek consist of part of the jaw bone of an extinct macropod, about as large as *Macropus titan,* with one much worn molar tooth, the centrum of a caudal vertebra, the proximal and distal ends of a tibia, and the distal end of a femur. All these bones may well belong to one individual, although the leg bones seem rather too large to match the mandible; but they are too fragmentary to allow definite conclusions to be drawn, and are merely put on record with the hope that better specimens will yet be found.

Sternum of a Ratite Bird (*Dromaius* sp.) from the Wellington Caves, N. S. Wales.

(Plate ix.)

Some years ago Mr. H. R. Quiney, then a geology student in the University of Sydney, presented to the Museum portion of the sternum of a ratite bird from the Wellington Caves, about 250 miles north-west of Sydney, well known as the source of many fossil specimens now preserved in various museums. Unfortunately, the specimen is incomplete and few diagnostic features are preserved, but it is evident that it conforms most nearly to the type exhibited by the sternum of the emu (*Dromaius*).

The bone as preserved measures 147 mm. in length by 118 in greatest breadth, and is remarkable for its thickness, which reaches 35 mm. just posterior to the level of the articulation of the last sternal rib. On the ventral surface (Pl. ix, fig. 1) there is a well-marked protuberance extending over the posterior half of the bone, which is here strongly convex. The surface for articulation of the sternal ribs is fairly well preserved on the right side, and shows four septa separated by deep pits, the most anterior of which is imperfect. This costal margin is almost parallel to the sagittal plane, to which it approaches slightly posteriorly; in the living emu the articular margins converge distinctly caudad. Of the coracoid grooves only the extreme lateral angles are preserved, the distance beween them measuring approximately 68 mm.

The following table gives available measurements for comparison with corresponding dimensions in the emu and the cassowary:

	A.	B.	C.	D.
Length	—	152	150	202
Span of coracoid grooves	68	57	65	92
Distance between facets for 1st sternal ribs	144	133	120	122
Distance between facets for last (4th) sternal ribs	138	107	108	98
Greatest thickness	35	28	27	10

A=*Dromaius* sp. Pleistocene, Wellington Caves. Austr. Mus., F.25,218.
B=*D. novæhollandiæ*. Austr. Mus., A.13,244.
C=*D. novæhollandiæ*. Austr. Mus., S.1515.
D=*Casuarius australis*. Austr. Mus., S.1435.

In general proportions the sternum most resembles that of the emu, from which it differs, however, in its greater thickness and the larger angle between the two pleurosteal surfaces; it apparently belonged to a larger and more robust bird than the recent emu. From the sternum of the cassowary the fossil is at once distinguished by its much greater thickness. The sternum of *Genyornis newtoni* as described by Stirling and Zietz[1] is quite different; it is much larger, yet its thickness is more or less constant at 20 mm. in the preaxial two-thirds, and diminishes to 6 to 8 mm. in the posterior third, where in *Dromaius* the thickness is greatest. The sternum of *Dromornis australis* is unknown.

From the Post-Tertiary deposits of the Darling Downs, Queensland, De Vis described two species of extinct emu: *Dromaius patricius*,[2] based on a left coracoid and the proximal and distal ends of a right tibia, and *D. gracilipes*,[3] the type of which is a fragmentary tarso-metatarsus. De Vis was of opinion that *D. patricius* had a shorter and stouter leg than *D. novæhollandiæ*, and that *D. gracilipes* was smaller than the latter. It is possible, therefore, that the Wellington Caves sternum belongs to *D. patricius*, but until a more complex skeleton is discovered no certainty on this point can be reached.

Fossil emu bones have been previously recorded from the Australian Pleistocene,[4] and in the Wellington Caves remains of both *Dromaius* and *Casuarius*[5] have been found.

CROCODILIAN JAW FROM NORTH QUEENSLAND.

(Plate x.)

This specimen was recently presented to the Museum by Mrs. M. E. Allan, with the information that it was collected about 1886 by her father, the late Edward Palmer. Unfortunately, the exact locality of the find is not known, but the donor is of the opinion that it was obtained in the Gregory River district; the Gregory River flows into the Gulf of Carpentaria near Burketown.

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[1] Stirling and Zietz.—*Mem. Roy. Soc. S. Australia*, i, 2, 1900, p. 72, pl. xxiii.
[2] De Vis.—*Proc. Linn. Soc. N. S. Wales*, iii (2nd Ser.), 3, 1888, p. 1290.
[3] De Vis.—*Proc. Linn. Soc. N. S. Wales*, vi (2nd Ser.), 1891, p. 445.
[4] Etheridge.—*Rec. Geol. Surv. N. S. Wales*, i, 2, 1889, pp. 132-4.
[5] Krefft.—Australian Vertebrates, Recent and Fossil, 1871, p. 37. Lydekker.—Brit. Mus. Cat. Fossil Birds, 1891, pp. 352-3, 354.

The specimen consists of the anterior portion of the two rami, fused at the symphysis, and showing the alveoli of seven teeth on the right and six on the left; no teeth are present, but portions of the roots remain in some of the alveoli.

This symphysial fragment is remarkable for its breadth and massive structure, in which it at once recalls *Pallimnarchus pollens* De Vis,[6] which it also resembles in that the symphysis terminates in a line joining the middle points of the sixth alveolus, where the greatest breadth is approximately 196 mm. The length of the symphysial suture is 108 mm., and the greatest depth in the symphysial plane (opposite middle of fourth tooth) is 62 mm. The width between the outer edges of the alveoli of the fourth tooth is 189 mm., and the alveolus has a diameter of 33 mm.; the alveolus of the first tooth ("incisor") is 31 mm. in diameter.

When these measurements are compared with those given by De Vis and Longman, allowance being made for variation due to possible age and sex differences, we may safely conclude that this specimen is part of the mandible of *Pallimnarchus pollens*.

EXPLANATION OF PLATES.

PLATE VIII.

Nototherium watutense, sp. nov. Roaring Creek, Watut River, Territory of New Guinea. Part of the left ramus of the mandible; natural size. F.36311.

PLATE IX.

Dromaius sp. sternum. Wellington Caves, N. S. Wales; × ½. F.25218.
Fig. 1.—Ventral view.
Fig. 2.—Dorsal view.

PLATE X.

Pallimnarchus pollens. ? Gregory River district, Queensland. Anterior part of mandible; × ¾. F.36947.

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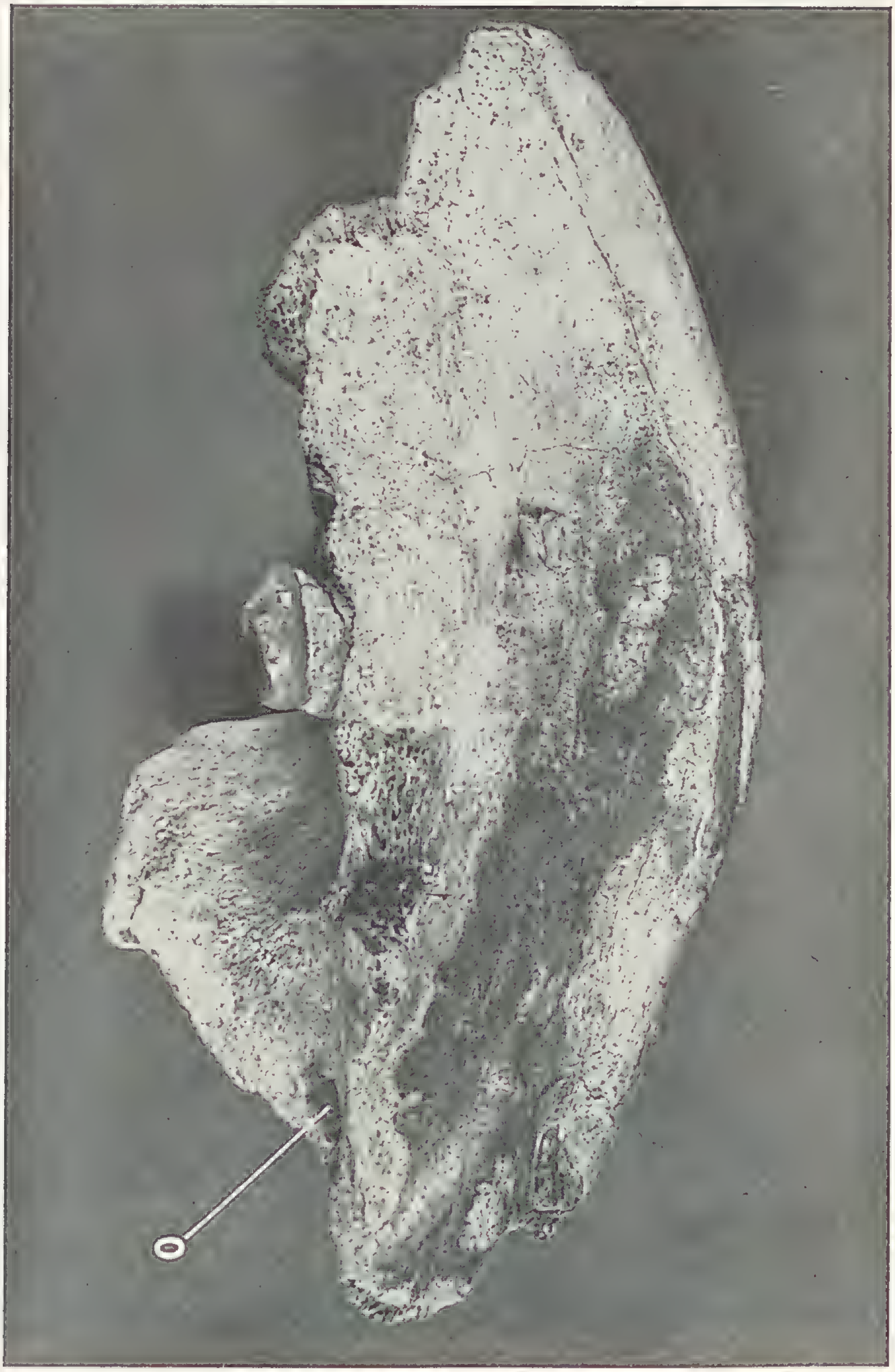
[6] De Vis.—*Proc. Roy. Soc. Q'land*, ii, 1885, pp. 181-191, pls. x-xv. Longman.—*Mem. Q'land Mus.*, viii, 1925, p. 103-8, pl. xxvi, fig. 1; ix, 1928, pp. 158-9, pl. xviii.



G. C. CLUTTON, photo.

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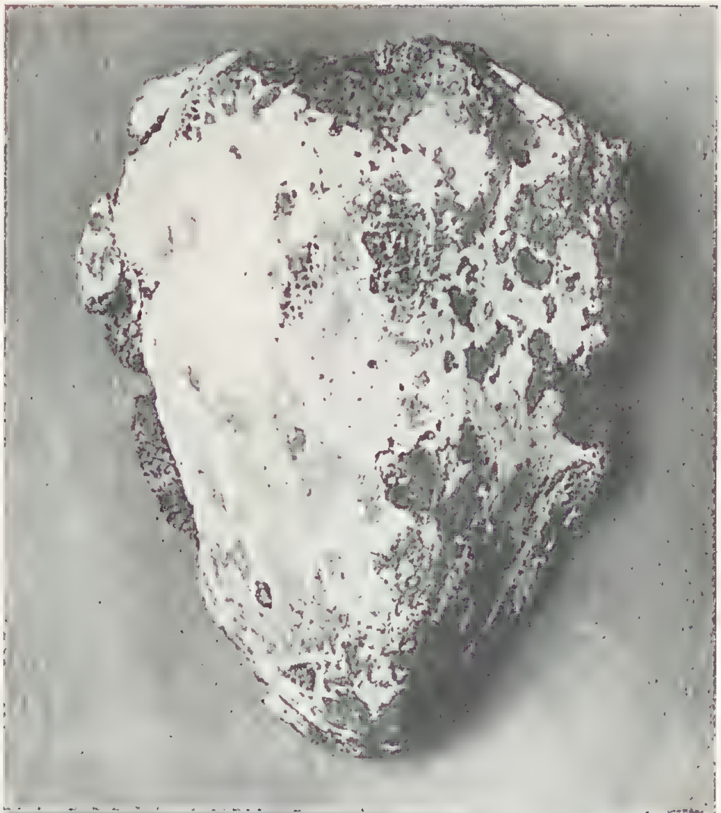

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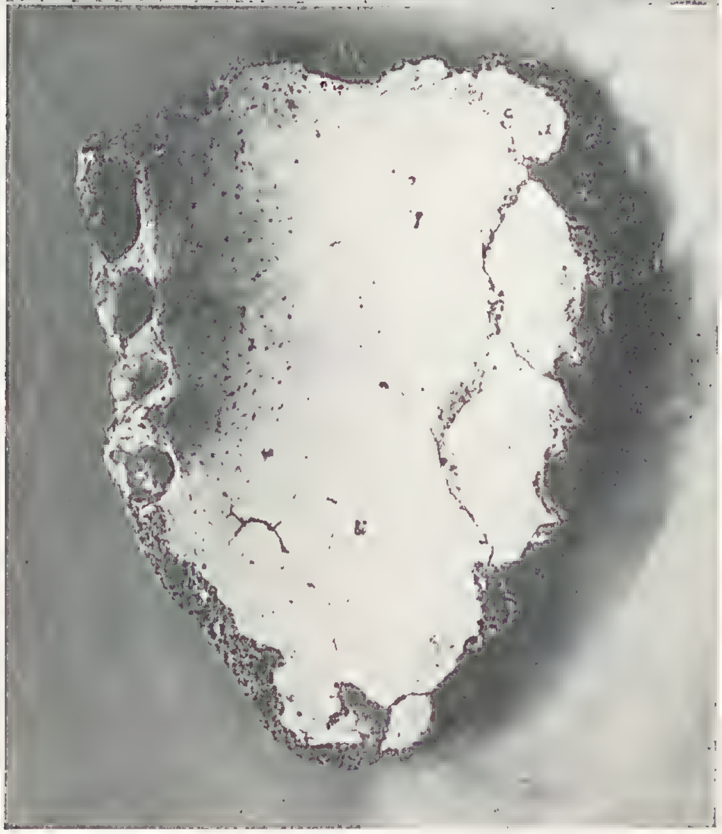

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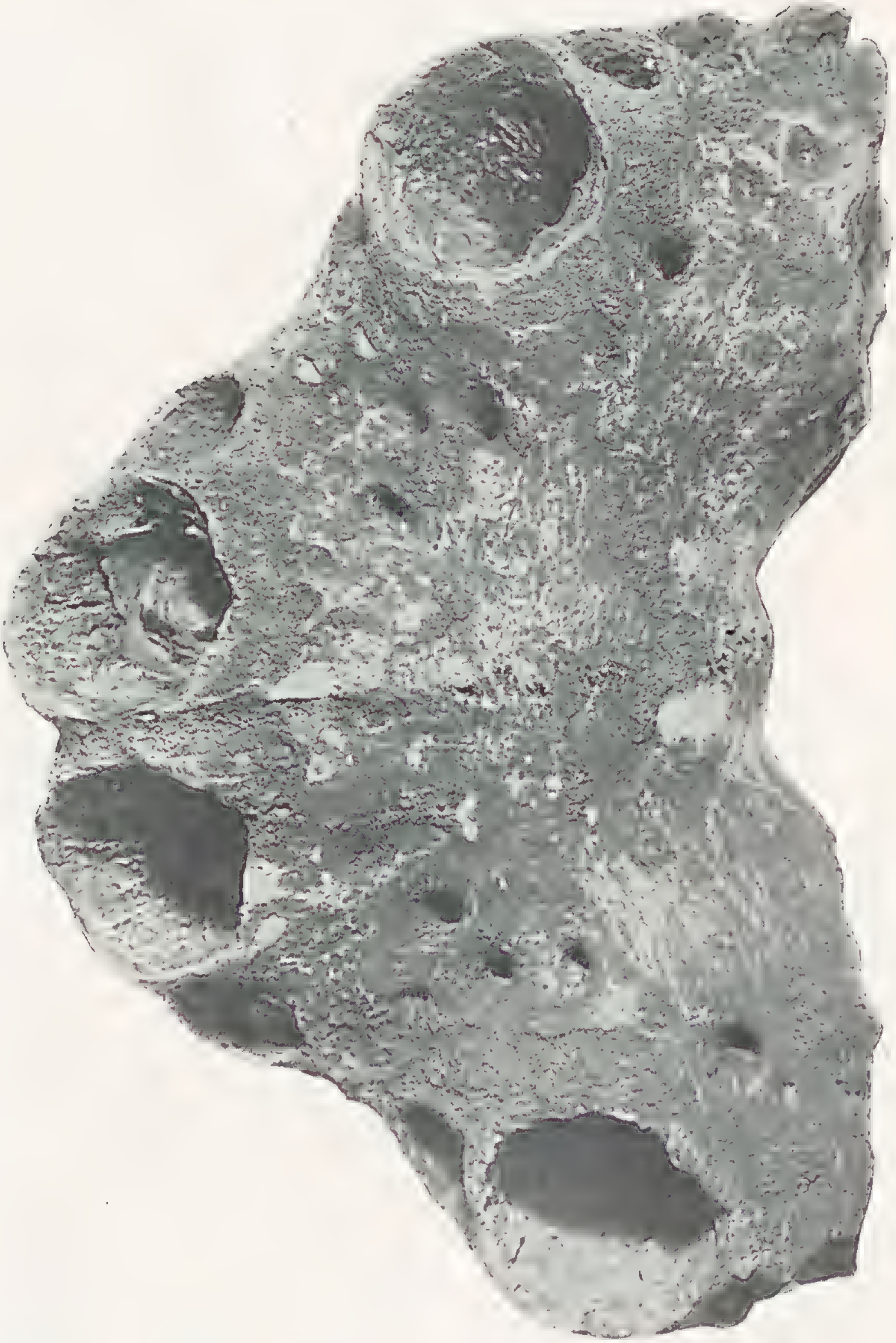

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THE AUSTRALIAN MASSIVE SPECIES OF THE CORAL GENUS *FAVOSITES*.

By

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(Plates xi–xvi.)

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I. Introduction.

AN attempt has been made in this work to place the massive species of the genus on a sound basis. A number of new species have been described, and type or topotype material of previously described species has been investigated. In cases where forms have been referred to extra-Australian species the types or topotypes of these have been examined as far as possible. This was done by the writer for many of the European species,[1] but it was not possible to investigate many of the American species in this manner, and, as little American material has been described from thin sections, comparison with American species has been difficult; some of the forms described as new by the writer may possibly prove to be referable to American species, when the latter have been investigated by means of thin sections.

Of those forms which have been ascribed to extra-Australian species, the description given is that of the Australian material.

The writer is indebted for much advice as to methods and other matters to Dr. Stanley Smith, of the University of Bristol, and to Dr. G. L. Elles, of Cambridge. He wishes to express his thanks to Dr. R. S. Allan for allowing him the use of his large Silurian collection, and to the authorities of the Australian Museum, Sydney, and the National Museum, Melbourne, for the loan of material; to Professor H. C. Richards and Drs. W. H. Bryan and F. W. Whitehouse for the loan of specimens from the University of Queensland collection; to Dr. W. D. Lang for the loan of specimens from the British Museum; and to Dr. G. L. Elles for reading the manuscript and many useful suggestions.

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[1] See Bibliography, p. 100; Jones, 1936.

II. History.

The first reference to the occurrence of the genus *Favosites* in Australia is found in the fossil descriptions by Lonsdale in Strzelecki's "Description of New South Wales", 1845. In that work a coral from Yass Plains was doubtfully referred to *Favosites gothlandica* Lam., but Lonsdale stated that it apparently had only one row of mural pores.

In 1848 Rev. W. B. Clarke, in a paper on the Trilobites of N. S. Wales, mentioned *Favosites gothlandica* and another species of *Favosites* as having been found at Yass Plains, but he gave no description or figure. Later, in 1860, in his excellent work on the southern goldfields, he gave a list of fossils named by Lonsdale. These included *Calamopora*, *Emmonsia* and *Favosites gothlandica*. The collection examined by Lonsdale was presented to the Sedgwick Museum, Cambridge, but only indefinite localities, such as "New South Wales", were given, so that the specimens, many of them splendidly preserved, are of no value for further research. The remainder of Clarke's collection, which was described by de Koninck, was destroyed by fire in 1882.

In 1868 J. J. Bigsby published his comprehensive work, "Thesaurus Siluricus", and quoted several Favositidæ from N. S. Wales.

Smyth, in 1874, mentioned the occurrence of *Favosites* in Victoria.

McCoy's "Prodromus of the Palæontology of Victoria", 1874–77, set a high standard in Australian palæontology. In Decade IV he described and discussed *Favosites goldfussi* from the Devonian beds of Buchan.

In 1876–7 de Koninck's description of W. B. Clarke's collection appeared, the author referring most of the forms to well-known European species. He did not give adequate descriptions of the actual Australian specimens, nor did he give figures. Add to these obvious defects the fact that the types have been destroyed and it becomes apparent that much of his work, in this family at least, is valueless. He determined the following Silurian species: *Favosites forbesi* Ed. & H., *F. aspera* d'Orb., *F. multipora* ? Lons., and *F. gothlandica* Fougt. The Devonian forms recorded were: *Favosites goldfussi* d'Orb. and *F. basaltica* (Gold.). From the Carboniferous he recorded a single form, *Favosites ovata* Lons., a species later referred by Etheridge to *Stenopora*.

R. Etheridge, junr., published, in 1878, a very useful "Catalogue of Australian Fossils", in which he gave the ages and localities of, and references to, all the Australian forms described up to that date.

In 1879 the first work on Queensland corals was published by H. A. Nicholson and R. Etheridge, junr. This comprised the description of the corals of the Daintree collection, and included *Favosites gothlandica* and *F. gothlandica* var. *goldfussi*.

Johnson, in his "Geology of Tasmania", 1888, repeated de Koninck's records for the mainland, and recorded two species of *Favosites* from the Gordon River limestone.

The "Geology and Palæontology of Queensland and New Guinea", by R. L. Jack and R. Etheridge, junr., 1892, still forms the basis for research into Queensland palæontology. *Favosites gothlandica* and a variety, *goldfussi*, were described from the Devonian rocks.

In 1898 a translation of de Koninck's memoir was published as a memoir of the Geological Survey of N. S. Wales; the coral section was translated by W. S. Dun.

In the same year W. S. Dun described a portion of Mr. Sweet's collection of Victorian fossils. He discussed the relationship of *Favosites gothlandica* and *F. goldfussi*, and agreed with Nicholson and Etheridge, junr., that the latter should be regarded as a variety of the former.

In 1899 R. Etheridge, junr., in an important paper on the Devonian Corals of the Tamworth District, N. S. Wales, made the greatest single contribution to our knowledge of the Australian Favositidæ. His work was an advance on that of de Koninck, as he gave an adequate description of the actual Australian forms figured. He described a form as *Favosites gothlandica* Lam.; new species were *F. squamulifera* and *F. multitabulata*; two new varieties of *F. basaltica* (Gold.), var *moonbiensis* and var. *salebrosa*, were also described, and a further species was not named, but was apparently close to *F. forbesi* Ed. & H. Etheridge gave good figures and photographs of thin sections, and this paper must form the basis of any further research on the Devonian species of the genus in N. S. Wales. His remarks on the genus *Favosites* may be appropriately quoted here: "I have experienced the greatest difficulty in identifying the *Favosites* of the Tamworth area, and, I may add, of the Australian rocks in general. This arises chiefly from the absence of good microscopic descriptions of the species established by the older European and American writers, except in the case of a few of the best known forms (and even these are often rendered difficult of comprehension by reason of the discrepancies which exist in the respective descriptions); and in a minor degree from the personal want of authenticated species of the countries named" (1899, p. 162).

In 1912 A. B. Walkom gave a thorough description of a new species of *Favosites*, *F. tripora*, from the Yass district, N. S. Wales.

In 1913 Chapman prepared a valuable summary of the Silurian rocks and fauna of Victoria for the Australasian Association for the Advancement of Science meeting for that year. It contained a complete list of the fauna, with localities and references, and was published in 1914.

In 1914 Chapman described and figured *Favosites forbesi* Ed. & H., and a new species, *F. nitida*, from Eastern Victoria.

Chapman in 1920 discussed and figured the species *Favosites gothlandica* Lam., *F. forbesi* Ed. & H., and *F. basaltica* (Gold.) var. *moonbiensis* Eth. fil., from the Yeringian of Eastern Victoria; in the following year he recorded *F. gothlandica* Lam. from Rushworth, and in a further paper he described and figured *F. forbesi* Ed. & H., and *F.* (*Emmonsia*) *spinigera*, sp. nov.

In 1922 W. N. Benson published a summary of the work on the Devonian rocks of Australia. This included a very useful bibliographic index of the fossils.

From this brief summary it can be seen that the work done on the Australian Favositidæ consists mainly of isolated descriptions, and that a complete monograph and a revision of the existing records are much needed. This is attempted in the following pages.

III. Structures of the Massive Forms of the Genus.

A great deal of confusion has arisen from the employment of the same terms in various senses by different authors. In discussing the structures of this genus the writer will endeavour, therefore, to make clear the exact sense in which he employs the various terms.

Corallum.—The corallum is invariably cerioid, but varies greatly in form and size. The forms fall into two broad divisions: (*a*) massive and (*b*) ramose or dendroid.[2] The massive forms, which alone are discussed here, may be globular, pyriform, hemispherical, or in irregularly shaped masses, and all these shapes are frequently found in the same species, the form of a particular individual evidently being mainly determined by environment. The corallites radiate from a point of attachment, which may be in the centre of the base or excentric. In size the massive forms are usually 100 cm. or less (down to as little as 1 cm.) in diameter, but they sometimes reach 200 cm. or more.

Basal Epitheca.—A basal epitheca appears to be always present, except in some globular or spherical colonies, in which the corallites open to all the free surfaces; but it is seldom preserved in weathered or rolled specimens. When seen, it is generally strong and concentrically wrinkled.

Corallites.—The corallites are usually prismatic, a natural result of the compound form; but, when thick-walled, are sometimes rounded, the inner layers of the walls being deposited concentrically. The relative size of the corallites may vary considerably from specimen to specimen and in the same specimen, and is dependent partly on rate of growth and environment. Sometimes two orders of size may be distinguished in a species, and this the writer has elsewhere[3] shown to be due to rapid growth in a restricted space.

The number of sides of the adult corallites is normally six, that number giving the geometrical form most economical of space. This is often increased to as many as nine when young corallites are present.

Pseudo-Opercula.—These are plates closing the mouths of the corallites, similar in appearance to those found in some of the Cystiphyllidæ. They have been described in a number of species by C. O. Dunbar (1927, pp. 101–14), who concludes that they are a modification of the normal basal epitheca. They have not been observed in any of the Australian species.

Epitheca or Wall.—The walls range from extremely thin and hair-like to moderately thick. They are of much the same thickness throughout their length, not having, as have some of the genera of the *Favosites*, a much greater thickness near the surface of the colony than elsewhere.

The "Dark Line".—The so-called "dark line" can usually be seen in the centre of the walls; it appears usually as a line darker than the rest of the walls, but is sometimes lighter. It was formerly supposed to be the junction of the original or "primordial" walls of adjacent corallites compressed together, the rest of the wall being "secondary"; but it has been shown by Miss Ogilvie (1897, p. 128) to be purely the line along which calcification began in two opposite directions, *i.e.*, the "centre" of calcification.

Septal Apparatus.—Septal lamellæ, *i.e.*, continuous lamellæ extending from the top to the bottom of the corallites, are never present in the genus *Favosites*. The septal elements consist of "septal spines"—denticles, tubercles or spines—which arise directly from the walls of the corallites, or frequently are absent altogether.

The spines vary considerably in form—sharp and needle-like, blunt, conical with a broad base and sharp point, etc.—and may be straight or curved, horizontal, or inclined upwardly. They often vary also in number and distribution both vertically and horizontally, even in different parts of the same specimen, and in specimens in which much recrystallisation has taken place they may be completely obscured. In longitudinal sections the spines may be seen in two ways, as spines projecting into the visceral cavity, or as dots, cross sections of the spines, when the section passes close to the corallite wall.

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[2] Ramose or dendroid does not, as with rugose corals, mean fasciculate; a ramose tabulate coral is one in which the corallites diverge from an imaginary axis, usually at an acute angle; the corallum may or may not branch. It still comes under the heading cerioid.

[3] For full discussion of this phenomenon see Jones, 1936, pp. 3-7.

The writer has not seen horizontal septa in any extra-Australian species, but a number of the Australian species exhibit this character in varying degrees; it is best seen in *F. librata*, sp. nov. In addition to the horizontal disposition of the septa, they are at the same level in contiguous corallites, which gives a striking appearance in longitudinal section. This may prove to be an environmental character and a constant varietal difference between the Australian species and otherwise similar species from some other area. This remains to be shown when thin sections of species from other areas are available.

Tabulæ.—The tabulæ may extend wholly across the corallites, when they are known as *complete tabulæ*, or may extend only part way, when they are called *incomplete tabulæ*. In the latter case they are frequently inosculating. In thick-walled species the tabulæ are usually thinner than the walls. The distribution and number of tabulæ depend upon the rate of growth of the corallum, and vary greatly from part to part of the same specimen, so that little weight can be attached to their number and distribution as a specific character. The tabulæ are said to be horizontal when they are perpendicular to the direction of their respective corallites, and oblique when they are inclined to that direction. In either case they may be concave or convex.

Squamulæ.—Squamulæ are horizontally projecting laminæ with a more or less tongue-like character. The term was introduced by Rominger (1876, p. 20), who used it in the above sense; but there has been considerable divergence of opinion as to their origin. Rominger, followed by Lambe and other American palæontologists, considered them to be of septal origin (see Rominger, 1876, p. 28; Lambe, 1899, p. 2).

Other palæontologists, notably H. A. Nicholson, have thought them to be a modification of tabulæ. Nicholson (1879, pp. 41–2) concludes: "The fact that their direction is one transverse to the axis of the visceral cavity, and that they occupy the entire width of one of the prismatic faces of a corallite, entirely precludes our believing that they can have been situated in the inside of one of the "mesenteries" of the living animal, and is thus fatal to the conception of their septal character. They must, on the other hand, be regarded as a peculiar modification of the *tabulæ* of the more typical species, and they not uncommonly coexist with these."

Smith and Gullick (1925, p. 116) also take the view that they are of tabulate origin: "it is more probable that they are retrograde tabulæ."

Considering the facts as stated by Nicholson, the writer is of the opinion that it is impossible to regard *squamulæ* as other than *incomplete* or *retrograde tabulæ*.

Mural Pores.—The mural pores of the Australian forms are almost invariably round, and are sometimes surmounted by a small raised rim. In all the species they are in the sides, not the angles, of the corallites.

Many palæontologists have inclined to the view that the arrangement and number of rows of pores are of small systematic value for two reasons; first, that they vary in number and arrangement in the same species and, indeed, in the same specimen, and, second, that they frequently cannot be seen owing to the type of preservation. The number of rows of pores on the corallite faces of a particular specimen certainly varies with the size of the face, but sometimes a small species has a greater number of rows than a larger. That is, the number of rows varies with the size of the face in the one species, but not from species to species. Further, by far the greater number of faces of a specimen are found to have the same number of rows, and this the writer has found to be constant for all specimens of the same species. This arrangement of pores may be called the *typical arrangement*, and, as will be seen later, is of some importance as a specific character.

With regard to the second objection, the mural pores can almost invariably be seen in longitudinal section if not in the hand specimen.

In the Australian Silurian specimens the preservation is such that the mural pores can usually be seen in the hand specimen. The Devonian ones are less well preserved in this respect, but the arrangement of the pores can be detected in longitudinal sections.

Beecher (1893*a*, p. 210), followed by Vaughan, regarded the mural pores as aborted buds, attempts at budding which failed owing to lack of space. While the tendency to reproduction is undoubtedly very strong in *Favosites*, this view of the function of the mural pores would imply a much greater activity than seems probable. Further, the mural pores are always opposite each other on faces that are in contact, *i.e.*, they form a communication from one corallite into the surrounding ones, and this fact is more in harmony with the view that the mural pores are homologous with the hollow connecting processes of *Syringopora*.

The writer has not succeeded in tracing any young corallites into mural pores, nor has he been able to observe a mural pore at the pointed base of any young corallite.

Reproduction.—Reproduction takes place by *lateral gemmation*, the bud always being affixed to the wall of the polyp and never to the peripheral region of the calyx.

Growth of Corallum.—According to Beecher (1893*a*, p. 210; 1893*b*, p. 215, *et seq.*), the first stage is that of a simple cyathiform corallite. The production of the first bud gives an *Aulopora*-like stage. Further lateral budding ensues, the first corallite is surrounded by a ring of buds, and the corallites become polygonal. Further increase takes place by budding at the periphery and by intermural gemmation whenever sufficient space appears between the polyps. This space obviously first appears at the corallite angles, so that the buds always arise there. The young corallites are at first triangular, but rapidly assume the hexagonal form of the adult corallites. Adult corallites with immature individuals adjoining them will have more than six (possibly up to twelve) sides.

Sufficiently young and complete coralla have not been found in Australia to test this mode of development.

Preservation.—Except for many of the specimens from the Bowspring limestone at Yass, which are silicified, the Australian forms are preserved in calcite. Specimens from the Upper Silurian at Yass generally split along the middle of the walls and are admirably suited for the observation of mural pores. In general, the Silurian specimens are not excessively crystalline, and the septa and other structures are seldom obscured. The Devonian forms are usually more crystalline, the septa are sometimes obliterated, and the mural pores can seldom be observed in hand specimens.

IV. Trends in the Australian Species.

Special attention has been given to the question of "trends" or lines of evolution in the Australian assemblage. Owing possibly to the non-existence or at least non-recognition and collection of Lower Devonian forms, it has not been possible to work out any definite lines; but two general tendencies may be noted: (1) The Middle Devonian forms have thicker walls than the Silurian. (2) Species with incomplete tabulæ are much more common in the Middle Devonian than in the Silurian, and the only species of *Emmonsia* occurs in the Middle Devonian.

V. List of Species Discussed in the Paper.

The genera and species to which the original author referred the forms are given in the left-hand column, and the genera and species in which the writer places them in the right. When an author has used a name with neither description nor figure it is not included in this list or in the synonymies. As the specimens described by de Koninck (1877) were destroyed and his figures are few and poor, his records are not listed.

	Favosites allani, sp. nov., p. 90.
Favosites basaltica (Gold.), var. *moonbiensis* Eth. fil., 1899	*F. basaltica* (Gold.) var. *moonbiensis* Eth. fil., p. 96.
F. basaltica (Gold.) var. *moonbiensis* Eth. fil.; Chapman, 1912*b*	,, ,, ,, , p. 96.
,, ,, ,, ; Chapman, 1920*b*	,, ,, ,, , p. 96.
F. basaltica (Gold.) var. *salebrosa* Eth. fil., 1899	*F. salebrosa* Eth. fil., p. 95.
	F. bryani, sp. nov., p. 96.
F. forbesi E. & H.; Chapman, 1914*b*	? *F. nitida* Chapman, p. 93.
,, ,, ,, ; ,, , 1920*b*	*Favosites* sp., p. 94.
F. goldfussi d'Orb.; McCoy, 1877	*F. goldfussi* d'Orb., p. 94.
	F. gothlandica Lam. var. *gothlandica* Lam., p. 86.
F. gothlandica Lam.; Nich. and Eth. fil., 1879	*Favosites* sp., sp. nov. (?), p. 98.
,, ,, ,, ; Eth. fil., 1892	*Favosites* sp., sp. nov. (?), p. 98.
,, ,, ,, ; Dun, 1898	*F. goldfussi* d'Orb., p. 94.
,, ,, ,, ; Eth. fil., 1899	,, ,, ,, , p. 94.
,, ,, ,, ; Chapman, 1907	? *F. allani*, sp. nov., p. 90.
,, ,, ,, ; ,, , 1914*a*	? ,, ,, ,, , p. 90.
,, ,, ,, ; ,, , 1914*b*	? ,, ,, ,, , p. 90.
,, ,, ,, ; ,, , 1920*a*	,, ,, ,, , p. 90.
,, ,, ,, ; ,, , 1920*b*	? ,, ,, ,, , p. 90.
,, ,, ,, ; Dun, 1898	*F. goldfussi* d'Orb., p. 94.
F. gothlandica Lam. var. *goldfussi* Nich. and Eth. fil., 1879	,, ,, ,, , p. 94.
F. gothlandica Lam. var. *goldfussi* Eth. fil., 1892	,, ,, ,, , p. 94.
	F. librata, sp. nov., p. 87.
F. multitabulata Eth. fil., 1899	*F. multitabulata* Eth. fil., p. 97.
,, ,, ,, ...	*F. murrumbidgeensis*, sp. nov., p. 98.
,, ,, ,, ; Chapman, 1912*a* ..	*F. multitabulata* Eth. fil., p. 97.
Favosites nitida Chapman, 1914	*F. nitida* Chap., p. 93.

F. ovata Lonsdale	Referred to *Stenopora* by Eth. fil. and Foord.
	F. regularis, sp. nov., p. 91.
	F. richardsi, sp. nov., p. 89.
Favosites (*Emmonsia*) *spinigera* Chapman	? *F. allani*, sp. nov., p. 90.
F. squamulifera Eth. fil., 1899	*Emmonsia squamulifera* (Eth. fil.), p. 99.
F. tripora Walkom, 1912	*F. tripora* Walkom, p. 88.
	F. yassensis, sp. nov., p. 92.

VI. The Age of the Various Species.

Name.	Age in Australia.	Age Elsewhere.
Favosites allani sp. nov.	Upper Silurian.[5]	—
F. gothlandica Lam. var. *gothlandica* Lam.	" "	Throughout the Silurian.[6]
F. nitida Chap.	" " (Yeringian).	—
F. regularis sp. nov.	" "	—
F. richardsi sp. nov.	" "	—
F. tripora Walkom	" "	—
F. yassensis sp. nov.	" "	—
F. bryani sp. nov.	Middle Devonian	—
F. goldfussi D'Orb.	" "	Throughout the Devonian.
F. moonbiensis Eth. fil.	" "	—
F. multitabulata Eth. fil.	" "	—
F. murrumbidgeensis sp. nov.	" "	Middle Devonian at Reefton, South Island of New Zealand (R. S. Allan, MS.).
F. salebrosa Eth. fil.	" " ? Silurian in Victoria.	—
Emmonsia squamulifera (Eth. fil.)	Middle Devonian.	—

The following facts stand out from this table:

(1) No Silurian species range into the Devonian.
(2) With one doubtful exception no Devonian species are found in the Silurian.
(3) Only two forms can be referred to extra-Australian species, and these agree in age with their extra-Australian age.

VII. Description of the Species.

Favosites gothlandicus Lamarck forma gothlandica Lamarck.

(Plate xi, figs 1–2.)

Favosites gothlandica Lamarck, 1816, p. 206. *Non* Nicholson and Etheridge, 1879, p. 219. *Non* Etheridge, junr., 1892, pp. 50–51, pl. 3, figs. 1–3; 1899, pp. 162–4, pls. xxii and xxiii. *Non* Chapman, 1907, p. 72; 1914, p. 222; 1920*a*, p. 173, pl. xiv, fig. 12; 1920*b*, p. 186, pl. xx, fig. 10, pl. xxi, figs. 12–14, pl. xxiii, figs. 18, 19. *Non* Benson, 1922, pp. 73–4.

Favosites gothlandica Lamarck. Smith and Gullick, 1925, pp. 118–9, pl. viii, fig. 1.

Favosites gothlandicus Lamarck forma *gothlandica* Lam. O. A. Jones, 1936, p. 9.

Description.—Corallum massive, pyriform or in irregular masses, probably also hemispherical. Corallites contiguous, prismatic, polygonal, radiating from a point in the base, three- to seven-sided, but with the six-sided predominating in numbers, equal or subequal, two to three millimetres in diameter; young corallites three-, four- or five-sided, intercalated amongst the older. Walls extremely thin or very slightly thickened. Septa absent. Mural pores circular, medium sized, surmounted by a small raised rim on the outsides of the corallites, typically in two, sometimes three or one, rows on each corallite face; the pores on one face usually alternate, but sometimes opposite or subopposite. Tabulæ complete, thin, usually horizontal, but may be slightly flexuous, four to six in a space of three millimetres.

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[5] Throughout the paper Silurian is used as equivalent to Gothlandian; thus Upper Silurian equals the Wenlock and Ludlow of England. Yeringian is the name used for the Upper Silurian of Victoria.

[6] This species has also been recorded from the Devonian of Europe and America. For discussion of these records see Jones, 1936.

Remarks.—The coralla of this species, in the writer's possession, are all incomplete and sometimes consist only of fragments; the majority appear to have been pyriform in shape; the largest, from near Molong, measures about 11 cm. across and was possibly twice as large originally. The basal epitheca has not been observed. No septa have been found in any specimen. Two of the specimens from Chillagoe, Queensland, referred to this species, are rather badly preserved; the corallites are rather smaller than in most of the specimens from other localities, but otherwise they agree well. A third specimen from Chillagoe has corallites of the more usual size, but is not sufficiently large to section.

The Australian representatives agree well with specimens of the species from Gothland and England,[7] with the exception that occasional feeble septal spines have been found in a few European specimens, while the Australian ones appear to be entirely devoid of them.

There have been many records of this species from various parts of Australia. The early records, such as those by Lonsdale (1845) and Clarke (1848 and 1860), are impossible to verify, since no figures are given and it has not been possible to trace the specimens. The others will be discussed under the species to which they are referred.

Localities.—Derrengullen Creek, Yass, N. S. Wales; Barrandella shales, Hatton's Corner, Yass, N. S. Wales; Bowspring limestone, Hatton's Corner, Yass, N. S. Wales; Rosebrook Caves, six miles N.N.E. of Cooma, N. S. Wales; about twenty miles north of Molong toward Cumnock, N. S. Wales; Wellington, N. S. Wales; Mungana, near Chillagoe, Queensland; Chillagoe Caves, Chillagoe, Queensland.

Age.—Upper Silurian.

Favosites librata,[8] sp. nov.

(Plate xi, figs. 3–6.)

Description.—Corallum massive, hemispherical; corallites radiating from a point in the base, prismatic, polygonal, subequal, two to three millimetres in diameter; young corallites triangular. Walls thin. Septa in the form of sharp spines with a broad, strong base, usually markedly horizontal, sometimes with slight upward inclination; usually at the same level in contiguous corallites, but often not at the same level on different faces of the same corallite; one or two, sometimes three, between each pair of tabulæ. Mural pores circular, or slightly elongated along the corallite; of medium size; one to one and a half times their diameter apart; typically in two rows on each corallite face; usually opposite or sub-opposite, but sometimes alternating. Tabulæ complete, horizontal, frequently concave upwards, regularly spaced, about one per millimetre.

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[7] For full discussion and description of these specimens see Jones, 1936, pp. 2-7.
[8] Libratus = horizontal. From the horizontal disposition of the septa.

Remarks.—The septa are very striking in this species; their broad bases, sharp points, horizontality, and the frequency with which they are on the same level in contiguous corallites, are very noticeable and characteristic features. They vary considerably in length and are irregularly spaced. The spacing of the tabulæ is more regular than in many species of the genus, but it varies somewhat from specimen to specimen.

The type of septa separates this species from any other of the same size. The writer has not observed similar septa in any species which occurs outside Australia, but some other Australian species show this character in a lesser degree.

Description of Holotype.—The holotype is a specimen from the Upper Silurian of Derrengullen Creek, Yass. It is an incomplete rather weathered colony, which originally was probably globular or almost so. The corallites radiate from a point and on the fractured surfaces the mural pores are exceptionally well displayed. A portion of the upper surface has been polished and two sections have been cut. The specimen is preserved in the Geological Museum of the University of Queensland.

Localities.—Derrengullen Creek, Yass, N. S. Wales; Limestone Creek, Yass, N. S. Wales; Humewood, near Yass, N. S. Wales; Wellington, N. S. Wales.

Age.—Upper Silurian.

Favosites tripora Walkom.

(Plate xii, fig. 1.)

Favosites tripora Walkom, 1912, pp. 700–1, pls. xxx–xxxi.

Description.—Corallum compound, massive, hemispherical or pyriform. Corallites radiating from a point, prismatic, polygonal, pentagonal and hexagonal forms predominating. Average diameter of corallites 2·5 to 3 mm. Walls thin. Septa well developed, short spines inclined upwards, twelve in number, regularly placed, and reaching only a short distance in from the walls. Mural pores rather small and typically in three rows, sometimes in two, alternately placed. Tabulæ thin, numerous, horizontal, and usually complete, very occasionally incomplete and inosculating, about two to one mm., usually opposite or sub-opposite in adjacent corallites.

Remarks.—This species is common at Yass and is distinguished by the constant number (twelve) of septa and the regularity of their spacing. This regularity is rare in the genus *Favosites*. The septa are obscured in some sections owing to crystallisation. This is the case with the holotype, in which the septa are better seen on the weathered surface, where they appear in the form of pits owing to the substance of the coral weathering away more rapidly than the matrix. This appearance of the weathered surface recalls Rominger's figures (1876, pl. iv, figs. 1, 3, 4; pl. v, fig. 2) of *F. favosus* and *F. niagarensis*. These species, however, differ in internal structure.

Walkom states that *F. tripora* is most closely allied to the coral from Tamworth described by R. Etheridge, junr., as *F. gothlandica*. *F. tripora* differs from this coral, which the writer refers to *F. goldfussi* d'Orb., in several particulars. In *F. tripora* the walls are thin, the septa are twelve in number and short, and the mural pores are typically in three rows. In the Tamworth coral the walls are moderately thick, the septa are long and irregularly distributed, and mural pores only in two rows.

The twelve regularly spaced septa distinguish this species from all other Australian species.

Description of Holotype.—The holotype is a specimen from Derrengullen Creek, Yass, and is now in the Queensland University Geological Museum. It was an incomplete weathered colony, which on being sectioned broke into seven pieces, four of which have been glued together and are figured in Pl. xii, fig. 7. It is about 7 cm. long, 3 cm. wide and 2 cm. thick. The appearance of the septa on the weathered upper surface has been referred to above. Slices have been cut from the upper and lower surfaces and from one end.

Localities.—Derrengullen Creek, Yass, N. S. Wales; Barrandella shales, Hatton's Corner, Yass, N. S. Wales; Bowspring limestone, Hatton's Corner, Yass, N. S. Wales.

Age.—Upper Silurian.

For the holotype of this species the writer is indebted to Dr. R. S. Allan, to whom Dr. A. B. Walkom was kind enough to give it for the purpose of this work.

Favosites richardsi, sp. nov.

(Plate xii, figs. 2–3.)

Description.—Corallum massive, pyriform, with a flattened top, or in irregular radiating masses. Corallites radiating from a central point of attachment in the base; contiguous, polygonal and prismatic. Corallites very variable in diameter, the adult being 2·5 to 4 mm. in diameter, but the many younger individuals may be as small as 1·5 mm. Most of the larger corallites have more than six sides owing to truncation of the angles by young corallites. Walls thin. Septal spines numerous, short but stout, with a rather broad base and sharply pointed; horizontally directed, or almost so, and usually at the same level in contiguous corallites; one or two spines between each pair of tabulæ. Mural pores large, and rather irregular in arrangement, but most usually in three rows on the faces of full sized corallites; the smaller corallites have often only two rows. Tabulæ complete, thin and horizontal; variable in number, 3 to 6 in a space of 3 mm.

Remarks.—This is a rather variable species, especially as regards size of the corallites, and spacing of the tabulæ. Septa were not observed in all specimens, some being much too crystalline for them to be preserved. The mural pores have only been seen in specimens from the Bowspring limestone at Hatton's Corner, Yass; all the specimens from this locality are silicified, but the mural pores are well displayed. The basal epitheca has not been observed, as most of the specimens are weathered, incomplete colonies.

This species is a rapidly growing one like *F. gothlandicus* forma *forbesi* and forma *multipora*.[9] It differs from these latter in the septal system; the var. *forbesi* has very few and irregular septa, while var. *multipora* has a large number of long and upwardly inclined septa.

The species is most nearly related to *F. librata* of the Australian forms. It differs in having slightly thicker walls, less strong septa, which are not so constantly horizontal, and less regularly spaced tabulæ; the mural pores are smaller and greater in number.

Description of Holotype.—A specimen from the Barrandella shales, Hatton's Corner, Yass. The specimen is a rather weathered colony, 7 cm. across and 3 cm. high; it has a flat top displaying well the corallites with their difference in size; the base terminates in an eccentric point of attachment, the corallites radiating from that point. A piece has been broken from one edge, from which to cut sections. The septa are visible in both transverse and longitudinal sections; the tabulæ are rather closer than the average for the species; mural pores cannot be seen.

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[9] See Jones, 1936, pp. 9-14.

The specimen is in the Queensland University Geological Museum.

Localities.—Barrandella shales, Hatton's Corner, Yass, N. S. Wales; Limestone Creek, Yass, N. S. Wales; Derrengullen Creek, Yass, N. S. Wales; Bowspring limestone, Hatton's Corner, Yass, N. S. Wales.

Age.—Upper Silurian.

Favosites allani, sp. nov.

(Plate xii, figs. 4–5.)

? *Favosites gothlandica* Lam.; F. Chapman, 1907, p. 72, pl. ii, fig. 5. *Id.* F. Chapman, 1914*a*, p. 222. *Id.* F. Chapman, 1914*b*, p. 303, pl. liii, fig. 20. *Id.* F. Chapman, 1920*a*, p. 173, pl. xiv, fig. 12. *Id.* F. Chapman, 1920*b*, p. 186, pl. xx, fig. 10; pl. xxi, figs. 12–14.

? *Favosites* (*Emmonsia*) *spinigera;* F. Chapman, 1921*b*, pp. 214–15, pl. xi, fig. 21.

Description.—Corallum massive, hemispherical, pyriform, globular or in irregular masses. Corallites polygonal and prismatic, but inclined to be irregular and variable in number of sides; triangular to octagonal, but pentagonal and hexagonal forms much predominating; subequal, diameter one to two millimetres. Walls thin. Septa numerous, short spines with a rather broad base, horizontally directed or with slight upward inclination, usually at the same level in contiguous corallites; in number very variable, but as many as sixteen in a cycle. Mural pores circular, with a slight raised rim, rather small, and about twice their diameter apart vertically; typically in one row in the centre of each corallite face, but quite frequently in two which alternate. Tabulæ numerous, thin, usually complete, very occasionally incomplete and inosculating; horizontal but inclined to be flexuous, close but rather irregularly spaced; seven to ten in a space of three millimetres.

Remarks.—The writer has not seen any complete coralla of this species, but specimens indicate that it may assume any of the forms mentioned above. The species is rather a variable one in respect to corallite size, resulting in a somewhat irregular appearance in transverse sections, but quite constant in its characteristic septa. In most specimens the septa are well preserved and easily observed in sections; in a few specimens in the writer's collections they are obscured by recrystallisation.

The specimens figured as *Favosites gothlandica* Lam. by Chapman (1920*b*, p. 186, pl. xx, fig. 10; pl. xxi, figs. 12–14) have been examined by the writer. They are well preserved and undoubtedly belong to *F. allani.* The corallites have a slightly greater diameter than those of the holotype, and the tabulæ are a little more distant, but the septa, most important structures, are exactly similar, as are the two species in all other respects. The other specimens referred to *F. gothlandica* by Chapman (1907, p. 72; pl. ii, fig. 5; 1914*b*, p. 303, pl. liii, fig. 20; 1920, p. 173, pl. xiv, fig. 12) are badly preserved, but very probably belong here also. Chapman (1921*b*, p. 214, pl. xi, fig. 21) described a form as *Favosites* (*Emmonsia*) *spinigera*, sp. nov.; the description and sole figure were "based on slice of a coral, the original specimen of which has been mislaid". The name *Favosites spinigera* is preoccupied by Hall (1879, p. 108, pl. 4, figs. 1–5). Judging from the only figure which Chapman gives, it belongs to *F. allani*; but the description does not agree so well. Thus the tabulæ are less numerous than in *F. allani* and the mural pores, though in a single line, are, according to Chapman, large and rare. Chapman mistakes what are obviously spinose septa for squamulæ ("incomplete and spine-like tabulæ"). He further compares these to "spiniform tabulæ" in *F. grandipora* Eth. fil., to which in another place (1914*b*, p. 309) he refers as spine-like septa. These structures in *F. grandipora* were considered, correctly, by Etheridge to be due to the breaking down of the weathered walls between the large, close mural pores. *Favosites* (*Emmonsia*) *spinigera* is here doubtfully referred to *Favosites allani*.

F. basaltica (Gold.) is a form with only one row of mural pores, but differs from *F. allani* in having no septa.

Description of Holotype.—The holotype, a specimen from Derrengullen Creek, Yass, is in the Geological Museum of the University of Queensland. It is an incomplete corallum with the corallites radiating from a point, five cm. across and eight cm. high. The corallites are masked by matrix on one side, but on the other, where the weathered surface has broken away the small corallites with one row of mural pores on each face, are well displayed. One slice has been cut from the top of the corallum.

Localities.—Derrengullen Creek, Yass, N. S. Wales; Limestone Creek, Yass, N. S. Wales; Barrandella shales, Hatton's Corner, Yass, N. S. Wales; Scarp, Yass River, N. S. Wales. (Age: Upper Silurian.) Native Dog Creek and Cowombat Creek (Limestone Creek Series, Eastern Victoria); Gibbo River and Benambra (Mitta River Series, Eastern Victoria). (Age: Yeringian.)

Specimens from the following localities are placed with reserve in this species: Markham's Caves, Chillagoe, Queensland; Wellington, N. S. Wales (Upper Silurian). Middle Crossing, Deep Creek, Walhalla, Victoria; Deep Creek, Thomson River, Gippsland, Victoria; Rushworth, near Heathcote, Victoria; Tyers River, Gippsland, Victoria. (Yeringian).

Favosites regularis, sp. nov.

(Plate xii, fig. 6; and Plate xiii, fig. 1.)

Description.—Corallum massive, in large masses or flattened expanses. Corallites apparently radiating from a point, prismatic, polygonal and markedly regular in size, 0·75 to 1 mm. in diameter; four- to seven-sided, but with the five-sided much predominating. Walls slightly thickened. Septa numerous and more than usually regular in number and spacing; in the form of spines, as many as fifteen in a cycle; rather variable in length, sometimes reaching half-way to the centres of the corallites. In form conical, sharply pointed, horizontal or almost so, usually at the same level in contiguous corallites. The mural pores are small, circular and typically in two alternating rows on each corallite face, but sometimes in only one; they are about twice their diameter apart vertically. Tabulæ very numerous, usually complete, but occasionally incomplete and inosculating, horizontal but often somewhat flexuous, regularly spaced, ten to twelve in a space of three millimetres.

Remarks.—The regularity of its structures, uniformity of size and constant number of septa are a feature of this species. It is common in the Bowspring limestone at Yass, and most of the specimens have been obtained from there. Unfortunately, nearly all the specimens from that locality are completely silicified and it is exceedingly difficult to get satisfactory sections from them.

The writer was in some doubt as to whether this species should be regarded as a distinct species or only a variety of *F. allani*. The fact that *F. regularis* is not only a slightly smaller form, but in spite of this has usually two rows, instead of one row, of mural pores, seems to be sufficient ground for their complete separation. The two species agree closely in their septa, but the tabulæ are rather more numerous in *F. regularis*.

Description of Holotype.—The holotype, a specimen from Hatton's Corner, Yass, is in the Australian Museum (F.8748). It is a flat incomplete colony of irregular shape, seven cm. across, but only one cm. thick. The corallites are masked by matrix over most of the under side, but are well displayed on top. Sections have been cut from the under surface and one side.

Localities.—Lower Scarp north of Hatton's Corner, Yass, N. S. Wales; Barrandella shales, Hatton's Corner, Yass, N. S. Wales; Bowspring limestone, Hatton's Corner, Yass, N. S. Wales; Derrengullen Creek, Yass, N. S. Wales; Black Dog Creek, Hatton's Corner, Yass, N. S. Wales. One specimen from a limestone on the Molong-Cumnock Road, about 20 miles north of Molong, is doubtfully included in this species.

Age.—Upper Silurian.

Favosites yassensis, sp. nov.

(Plate xiii, figs. 2–3.)

Description.—Corallum massive, hemispherical or globular. Corallites prismatic, polygonal, small, 0·75 to 1 mm. in diameter. Many young corallites are present in the coralla and give a rounded appearance to the many-sided larger ones. Walls moderately thin. Septal spines, very short, sharp with an upward inclination, numerous. About fifteen in a cycle. Mural pores small, circular, typically in three rows, sometimes only in two; the rows usually opposite, but the centre one may alternate with the other two. Tabulæ very numerous, thin, complete and horizontal; usually evenly spaced, but the number varies a little from specimen to specimen; fourteen to twenty in a space of three millimetres.

Remarks.—This species presents likenesses to both *F. allani* and *F. regularis*, but the extremely short upwardly inclined septa serve to distinguish it from both of these. Being inclined upwards and also very short, the septa appear in transverse sections as little more than notches on the corallite walls; their character is better seen in longitudinal sections. The mural pores have not been seen in any of the hand specimens, but appear in most of the sections and seem to be most commonly in three rows.

Description of Holotype.—The holotype is a specimen from the Barrandella shales, Hatton's Corner, Yass, N. S. Wales, and is in the Geological Museum of the University of Queensland. It is an incomplete corallum which was probably originally globular in form. It is six cm. long, three cm. wide and four cm. high, and is entirely free of matrix. Sections have been cut from the under surface and one end.

Localities.—Barrandella shales, Hatton's Corner, Yass, N. S. Wales; limestone scarp, N.E. of first bend in river, Hatton's Corner, Yass, N. S. Wales; Limestone Creek, Yass, N. S. Wales.

Age.—Upper Silurian.

Comparative Table Showing the Characters of *F. allani*, *F. regularis* and *F. yassensis*.

	F. allani.	*F. regularis.*	*F. yassensis.*
Size of corallites ..	1 to 2 mm.	0·75 to 1 mm.	0·75 to 1 mm.
Septa	Numerous short, horizontal spines with a broad base.	Horizontal spines with broad base, longer than those of *F. allani*, variable in length, may reach half-way to centre of corallite.	Very short upwardly inclined spines with broad bases.
Mural pores	Small, circular, typically in one row.	Small, circular, typically in two rows.	Small, circular, typically in three rows.
Tabulæ	Thin, horizontal, usually complete. 7–10 in 3 mm.	Thin, horizontal, complete. 10–12 in 3 mm.	Thin, horizontal, complete. 14–20 in 3 mm.

Favosites nitida Chapman.

(Plate xiii, figs. 4–5.)

Favosites nitida F. Chapman, 1914*b*, p. 309, pl. liv, figs. 21–23; pl. iv, figs. 24, 25.

? *Favosites forbesi* E. and H.; F. Chapman, 1914*b*, p. 308, pl. liii, fig. 19; pl. lvi, fig. 27.

Original Description.—"Corallum of moderate size; largest specimens measuring about 7 or 8 cms. Corallites slender, radiating, with moderately thick walls; normally hexagonal but sometimes pentagonal or sub-rectangular, with two of the sides reduced by crowding of contiguous corallites. Diameter of corallites 0·5 to 0·75 mm. In transverse section showing traces of spiny septa; maximum number 12, two on each corallite face when fully developed. In vertical section the mural pores are seen to be placed in a single row, sometimes sinuous, down the centre of each corallite face, and are of large size (0·17 mm. in diameter); smaller dark dots are visible on the corallite walls, and are the bases of septal spines. Tabulæ numerous, 3 or 4 in the space of 1 mm., somewhat irregular, horizontal, concave or oblique."

Remarks.—Chapman observes (p. 309) that some specimens of this species are very like *F. salebrosa* Eth. fil., but that this last species has no septa. The writer has found[10] septal spines in *F. salebrosa*, but they are not so numerous as in *F. nitida*, and they are rather shorter in the only specimen (a paratype) of *F. nitida* which he has had the opportunity to examine. The tabulæ are also more numerous in *F. nitida*.

The two species are much alike, and possibly should be united, but the writer is reluctant to do so until he has examined more material of *F. nitida*.

The uniting of these two species would extend the range of *F. salebrosa* from the M. Devonian to the Yeringian; Chapman (1912*b*, p. 232) has already suggested the presence of *F. moonbiensis* Eth. fil., another M. Devonian form, in the Yeringian of Eastern Victoria.

Chapman compared *F. nitida* with *F. grandipora* Eth. fil., but the latter is a ramose species with extremely large mural pores.[11]

The writer has examined the specimen figured (pl. liii, fig. 19) by Chapman as "*F. forbesi*; E. & H."; in common with many writers, Chapman has not understood the characters of that species and the form in question cannot be referred to it. In external appearance it is very similar to *F. nitida*; the calyces have a very slightly greater diameter and no definite septa have been seen, but they may be present. Chapman states that the mural pores are like those of the form he called *F. gothlandica* Lam.[12]

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[10] See p. 95.

[11] Chapman stated that *F. grandipora* has "slender septal spines". The appearance of spines in the longitudinal section is caused by the breaking down of the wall where the large mural pores almost meet.

The specimen should possibly be referred to *F. nitida*.

Localities.—Middle crossing, Deep Creek; and Cooper's Creek, Walhalla, Victoria.

Age.—Yeringian (Upper Silurian).

Favosites sp.

Favosites forbesi E. & H.; F. Chapman, 1920*a*, p. 186, pl. xxii, figs. 16, 17.

The writer has examined the specimen figured by Chapman (pl. xxii, fig. 17). It may represent a new species, but enough material has not been obtained to justify a new name. The corallites are about 1·5 mm. in diameter; the walls are moderately thin; septa are very numerous in the form of short sharp spines, inclined upwards. They appear in Chapman's figure, which is a good illustration, both as spines and cross sections of spines. The tabulæ are complete and numerous, six to eight in a space of 3 mm. The mural pores have not been observed by the writer, and Chapman makes no statement concerning them.

Locality.—Gibbo River, Benambra, Victoria.

Age.—Yeringian (Upper Silurian).

Favosites goldfussi d'Orbigny.

(Plate xiii, fig. 6; and Plate xiv, fig. 1.)

Calamopora gothlandica; Goldfuss, 1829, tab. xxvi, fig. 3*b* (*cæt. exclusis*).

Favosites goldfussi (pars); A. d'Orbigny, 1850, p. 107 (fig. 3*b* of Goldfuss only). *Id.* McCoy, 1876, p. 15, t. 35, figs. 1*a-d*.

Favosites gothlandica var. *goldfussi*; H. A. Nicholson and R. Etheridge, junr., 1879, p. 219. *Id.* R. Etheridge, junr., 1892, p. 51, pl. 3, figs. 1–3.

Favosites gothlandica; W. S. Dun, 1898, pp. 81–2, pl. iii, fig. 9. *Id.* R. Etheridge, junr., 1899, p. 162, pls. xxii, xxiii. *Id.* W. N. Benson, 1922, pp. 73–74.

Favosites goldfussi d'Orb.; O. A. Jones, 1936, pp. 19–21, pl. 11, figs. 8–10.

Description.—Corallum compound, either in spheroidal or hemispherical masses. Corallites prismatic, polygonal—triangular to heptagonal—the pentagonal and hexagonal forms predominating, from 2 to 2·5 mm. in diameter; young corallites triangular and quadrangular. Walls moderately thick; "dark line" usually visible in the centre of the walls. Septa numerous and well developed, but irregularly disposed; in the form of rather blunt spines with a slight upward inclination. Mural pores round, of medium size, typically two, sometimes three, alternating rows on each corallite face. Tabulæ numerous, usually complete, but occasionally incomplete and inosculating; generally horizontal, sometimes slightly oblique, three or four in a space of 3 mm.

Remarks.—The above description differs only in a few minor details from that given by Etheridge (1899, p. 162). Etheridge referred the form to *F. gothlandica*, regarding *F. goldfussi* as at least not more than a variety of the former.

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[12] This has one row of mural pores and is referred by the writer to *F. allani*, q.v.

The writer has discussed these two species elsewhere[13] and shown them to be distinct.

Etheridge (1899, pl. xxii, fig. 2) gives a figure of a transverse section which he described as ". . . horizontal section without septa"; even if a few septa do not appear in the figure, which in the writer's opinion is a doubtful point, they are plentiful elsewhere in the section. Septa do not appear in all the corallites at the level at which the section was cut; this is due in part to the irregular distribution of the septa and possibly in part to the crystalline preservation of the specimen.

Neither of the specimens figured by Etheridge, one of which is also figured by the writer, shows the mural pores, but these appear in sections of other specimens in the Australian Museum.

Localities.—Parish of Woolomol, Tamworth, N. S. Wales; Moore Creek, Tamworth, N. S. Wales; Nemingha, Tamworth, N. S. Wales; foot of Mt. Etna, Rockhampton, Queensland; Broken River, Burdekin Downs, North Queensland.

Age.—Middle Devonian.

Favosites salebrosa Eth. fil.

(Plate xiv, figs. 2–6.)

Favosites basaltica (Gold.) var. *salebrosa*; R. Etheridge, junr., 1899, p. 167, pls. xxi, figs. 3–5; xxvii figs. 1, 2.

Favosites salebrosa Eth. fil.; W. N. Benson, 1922, p. 75.

Syntypes.—Specimens in the Australian Museum from the Parish of Woolomol, near Tamworth, N. S. Wales (Woolomol limestone).

Lectotype.—The specimen figured by Etheridge (1899, pl. xxvii, figs. 1, 2) (Australian Museum, F.4288) is here selected as lectotype.

Emended Description.—Corallum compound, massive, with rough hackly appearance. Corallites small, prismatic, and polygonal—quadrangular to hexagonal—pentagonal predominating; often rendered irregular in outline in consequence of thickening, then becoming somewhat cylindrical, one-half millimetre in maximum diameter. Walls moderately thick, particularly at the angles of junction of the corallites. Septa in the form of rather blunt short spines, not very numerous, and irregularly distributed. Mural pores large, uniserial, in the centre of each prismatic face of a corallite, about three-quarters of a millimetre apart, margins depressed, without elevated rim. Tabulæ complete, unthickened, distant about three-quarters of a millimetre apart, or two in the space of one and a half millimetres; usually horizontal, occasionally oblique, seldom curved, never inosculating, opposite or sub-opposite. Old visceral chambers nearly square as a rule, the vertical diameter perhaps a little greater than the transverse.

Remarks.—Etheridge (1899, p. 166) for some reason failed to recognise septa; the writer has, however, found them in several undoubted specimens of this species, including some of Etheridge's sections. They are very short and might easily be masked by recrystallisation.

Compared with *F. basaltica* var. *moonbiensis*, this is a much smaller form and the tabulæ are much further apart.

In size of corallites, thickness of walls, a tendency to a cylindrical shape of the corallites, and in having one row of mural pores, this species is like *F. basaltica* (Gold.). The presence of septa and fewer tabulæ are, however, a sufficient distinction from the latter.

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[13] See Jones, 1936, pp. 2-12, pp. 21-22.

Description of Lectotype (Pl. xiv, figs. 2–3).—Australian Museum specimen (F.4288) from Portion 38, Parish of Woolomol, Tamworth, N. S. Wales. It is an irregular wedge-shaped mass of maximum length 8 cm., maximum width 7 cm. and maximum thickness 5 cm. The corallites are in part silicified, and, standing out above the matrix, give the specimen a rough hackly appearance; they are very irregular and run in all directions, cutting the surface at all angles. A section has been cut from one end.

Localities.—Portion 38, Parish of Woolomol, Tamworth, N. S. Wales; Moore Creek, Tamworth, N. S. Wales; Nundle Road, Moonbi, near Tamworth, N. S. Wales; Clear Hill, Taemas, Yass district, N. S. Wales.

Age.—Middle Devonian.

Favosites basaltica (Gold.) var. **moonbiensis** Eth. fil.

(Plate xv, figs. 1–2.)

Favosites basaltica (Gold.) var. *moonbiensis*; R. Etheridge, junr., 1899, pp. 164–5, pl. xxiv, figs. 1, 2; pl. xxix, fig. 2. *Id.* F. Chapman, 1912*b*, p. 219, t. 33, fig. 12; t. 35, fig. 7. *Id.* F. Chapman, 1920*b*, p. 187, t. 22, fig. 15; t. 24, fig. 21. *Id.* W. N. Benson, 1922, p. 72.

Description.—Corallum compound, large, oval, compressed. Corallites prismatic and polygonal, quadrangular to heptagonal, but the pentagonal and hexagonal forms predominating, one millimetre in diameter, and in the mature state very constant in size. Walls moderately thick; "dark line" visible here and there. Mural pores of medium size, in one row on each prismatic face of a corallite, continuous in one line, not alternating or zig-zag, depressed, and without elevated rims or margins. Septa absent. Tabulæ numerous, generally complete, horizontal, or slightly oblique, at times a trifle convex; at rare intervals incomplete and inosculating, four or five in a space of one millimetre, opposite or sub-opposite in contiguous corallites.

Remarks.—In the main this description follows that of Etheridge. The form is closely allied to *F. basaltica* (Gold.), differing from it only in having very slightly thinner walls and no tendency to a cylindrical form of the corallites, and in having more tabulæ.

Chapman (1912*c*, p. 232) records this species from the Thomson River beds of Yeringian (Upper Silurian) age. He does not give a description or a figure, and the writer has not been able to examine the specimen, so that he cannot express any opinion.

The writer has not been able to examine the specimen figured by Chapman (1920*b*), but from his remarks it appears to be correctly referred to this variety.

Localities.—Beedle's freehold, near Moonbi, N.E. of Tamworth, N. S. Wales; Moore Creek, Tamworth, N. S. Wales; pass on road between Moonbi Range and Newgate Flat, Nundle Road, near Tamworth, N. S. Wales. (Middle Devonian.) A doubtful record from Limestone Creek opposite the junction of Painters Creek, Eastern Victoria. (Probably Middle Devonian.)

Favosites bryani, sp. nov.

(Plate xv, figs. 3–6.)

Description.—Corallum compound, massive. Corallites prismatic, polygonal, hexagonal much predominating; rather irregular in shape, 1 mm. in diameter. Walls moderately thick, with the "dark line" visible in the centre. Septa in the form of slender, sharply pointed spines of considerable length, often reaching one-third to one-half way to the centre of the corallites; not very numerous, usually two rows on each fully developed corallite face, regularly spaced vertically and usually at the same level in contiguous corallites. Mural pores of medium size, in one row on each prismatic face of a corallite. Tabulæ numerous, generally complete, occasionally incomplete and inosculating, horizontal or slightly oblique, about ten in a space of 3 mm.; usually opposite or sub-opposite in contiguous corallites.

Remarks.—This species has close resemblances to *F. basaltica* var. *moonbiensis*, but is easily distinguished from it by the possession of septa. Apart from this difference, the likenesses are so great that the writer at first thought that septa were in reality a structure of *F. basaltica moonbiensis*, but obscured by recrystallisation. But the septa are so long and regular in *F. bryani* that it is very unlikely that they could be completely obscured in all the numerous specimens examined.

The species has been found only in the Murrumbidgee area, and no complete coralla have been seen by the writer. One corallum, however, measures 12 by 11 by 6 cm.

Description of Holotype (Pl. xv, figs. 3–4).—The holotype is the Australian Museum specimen F.5550, from Good Hope, near Yass. It is only a small fragment of a corallum, but has been chosen in preference to larger, as sections from it show the structures very clearly. The specimen is in two pieces, the larger of which has a maximum length of 6 cm., maximum breadth of 5 cm. and thickness of 2 cm. The smaller measures 2 by 1 cm., and two sections (A.M.93) have been cut from it. The matrix is a white limestone, throwing the black coral structures into strong relief. The corallites originally radiated from a point, but the lower portion of the corallum is not preserved.

The other specimen (F.8273, Australian Museum) figured (Pl. xv, figs. 5, 6) is larger, measuring 10 by 6·5 by 5 cm. It is apparently a portion of a hemispherical corallum, and has a similar preservation to the holotype. Sections have been cut from one end.

Localities.—Good Hope, near Yass, N. S. Wales; first limestone on Taemas Bridge Road from Yass, N. S. Wales; limestone at Yass end of Taemas Bridge, N. S. Wales.

Age.—Middle Devonian.

Favosites multitabulata Eth. fil.

(Plate xvi, figs. 1–2.)

Favosites multitabulata; R. Etheridge, junr., 1899, p. 168, pl. xviii, fig. 6; pl. xxvi.

Favosites multitabulata Eth fil.; F. Chapman, 1912*a*, p. 218, pl. xxxv, fig. 6. *Id.* W. N. Benson, 1922, p. 74.

Description.—Corallum compound, massive. Corallites prismatic, polygonal, quadrangular to heptagonal, but principally hexagonal, from 0·75 to 1·5 mm. in diameter. Walls moderately thick; "dark line" usually visible. Septa spiniform, short, numerous. Mural pores in two alternating series on each corallite face, moderately large, impressed. Tabulæ very numerous and close, from five to eight in one millimetre, complete, horizontal, opposite or sub-opposite in contiguous corallites.

Remarks.—Only one other Australian species, *F. yassensis*, has tabulæ as numerous as this species, and it differs considerably in other respects.

Tabulæ are often very variable in number in different parts of the same specimen, but in this case the great number of tabulæ is so constant both in the same and in different specimens that it probably has some specific significance.

Chapman (1912*a*, p. 216, t. 30, figs. 4, 5) recorded and figured this species from the Middle Devonian limestone of Buchan. He gave no description, but there is little doubt from his figure that his reference to this species is correct. The writer has obtained other specimens of the species from the same locality.

Localities.—Beedle's freehold, near Moonbi, N. S. Wales; Nemingha, near Tamworth, N. S. Wales; Toongabie, near Buchan, Victoria.

Age.—Middle Devonian.

Favosites murrumbidgeensis, sp. nov.

(Plate xvi, figs. 3–4.)

Description.—Corallum massive, spherical or irregular in shape, with the corallites radiating from a point in the base. Corallites contiguous, polygonal, trigonal to octagonal, rather irregular in shape, small diameter, 0·75 to 1 mm. Walls moderately thick. Septa spiniform, few in number, irregularly spaced horizontally, but fairly regularly vertically, of variable length, sometimes reaching almost to the centre of the corallites, but usually only one-third to one-half of the distance; they are sharply pointed and inclined slightly upward. The mural pores are circular, or slightly elongated along the corallites, of medium size, in one row on each corallite face. The tabulæ are thin, often flexuous, complete and incomplete; the latter join on to another tabula or on to a septal spine, six to twelve in a space of 3 mm.

Remarks.—This species shows more incomplete tabulæ than any other Australian species belonging to genus. Complete and incomplete tabulæ are about equal in number.

Description of Holotype.—The specimen in the Australian Museum (F.9576), from Clear Hill, west of Boambolo Crossing, Murrumbidgee River. It is small and almost spherical in shape, but slightly elongated in one direction. It measures 6 by 5 by 4 cm. The corallites radiate from a point, but open on to almost all the surface. They are preserved in black in a bluish-grey matrix. Two slices have been cut from it.

Localities.—Clear Hill, west of Boambolo Crossing, Murrumbidgee River, N. S. Wales; Taemas, near Yass, N. S. Wales; foot of Mt. Etna, Rockhampton, Queensland.

Age.—Middle Devonian.

Favosites sp., sp. nov.?

(Plate xvi, figs. 5–6.)

Favosites gothlandica; H. A. Nicholson and R. Etheridge, junr., 1879, p. 219. *Id.* R. Etheridge, junr., 1892, p. 50, pl. 3, figs. 4, 5.

The specimen described by Nicholson and Etheridge in 1879 and figured by Etheridge in 1892[14] is in the British Museum (Natural History), and has been examined by the writer. As the preservation is very bad, excessive recrystallisation having taken place, the writer is reluctant to give it a new name, though it probably does not belong to any of the foregoing species. Two other badly preserved specimens, one from Nemingha and the other from the foot of Mt. Etna, Rockhampton, are probably conspecific with it.

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[14] Etheridge simply quoted his and Nicholson's description (1879).

The form is possibly a small variety of *F. goldfussi.* Indeed, Nicholson and Etheridge stated that they had intermediate forms between it and what they called *F. gothlandica* var. *goldfussi* (referred by the writer to *F. goldfussi*, q.v.), but the writer has not been able to trace these specimens and has observed no intermediate forms. The corallites are about 2 mm. in diameter, and have moderately thick walls. Septa are numerous, strong and short. The tabulæ are complete, horizontal, regularly spaced, three or four in a space of 3 mm. The mural pores have not been observed.

Localities.—Broken River, a tributary of the Burdekin River, Queensland; foot of Mt. Etna, Rockhampton, Queensland; Nemingha, near Tamworth, N. S. Wales.

Age.—Middle Devonian.

Emmonsia squamulifera (Eth. fil.).

Favosties squamulifera; R. Etheridge, junr., 1899, pp. 166–7, pl. xxxviii, figs. 4, 5.
Id. W. N. Benson, 1922, p. 75.

For description and figures, see Etheridge, 1899.

Remarks.—Etheridge did not recognise the genus *Emmonsia* as distinct from *Favosites*, but Smith and Gullick (1925, p. 119) have shown it to be distinguished from the latter by having the tabulæ wholly or almost wholly replaced by squamulæ. This is certainly the case in this species; in fact, Etheridge (1899, p. 167) pointed out its resemblance to the genotype of *Emmonsia*, *E. hemispherica* (Yandell and Shumard). From that species it differs in having only one row of mural pores. It is also closely allied to *F. epidermata* Rominger (1876, p. 29, pl. 8, figs. 1, 2, 3), which has only one row of pores.

Locality.—Tamworth, N. S. Wales.

Age.—Middle Devonian.

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EXPLANATIONS OF PLATES.

PLATE XI.

(In this and succeeding plates all photomicrographs are untouched and magnified 4⅔ diameters.)

Favosites gothlandica Lam. var. *gothlandica* Lam.

Fig. 1.—Transverse section of a specimen from Derrengullen Creek, Yass, showing the thin walls. University of Queensland, No. F.226. O. A. Jones collection. Section No. T1.

Fig. 2.—Longitudinal section of the same specimen, showing the complete regularly spaced tabulæ. Section No. T2.

Favosites librata, sp nov.

Fig. 3.—Transverse section of the holotype. University of Queensland, No. A.8. O. A. Jones collection. Section No. S46.

Fig. 4.—Longitudinal section of the holotype, showing the peculiar septa. Section No. S47.

Fig. 5.—Transverse section of the holotype. University of Queensland, No. A.95. O. A. Jones collection. Section No. T83.

Fig. 6.—Longitudinal section of the holotype. Section No. T84.

PLATE XII.

Favosites tripora Walkom.

Fig. 1.—Transverse section of a specimen from Derrengullen Creek, Yass, showing the regular septa. University of Queensland, No. F.210. O. A. Jones collection. Section No. S14.

Favosites richardsi, sp. nov.

Fig. 2.—Transverse section of the holotype. University of Queensland, No. A.13. O. A. Jones collection. Section No. S59.

Fig. 3.—Longitudinal section of the holotype. Section No. S58.

Favosites allani, sp. nov.

Fig. 4.—Transverse section of the holotype. University of Queensland, No. A.1. O. A. Jones collection. Section No. S33.

Fig. 5.—Longitudinal section of the holotype. Section No. S34.

Favosites regularis, sp. nov.

Fig. 6.—Transverse section of the holotype. Australian Museum, No. F.8748.

PLATE XIII.

Favosites regularis, sp. nov.

Fig. 1.—Longitudinal section of the holotype. Australian Museum, No. F.8748.

Favosites yassensis, sp. nov.

Fig. 2.—Transverse section of the holotype. University of Queensland, No. A.14. O. A. Jones collection. Section No. S60.

Fig. 3.—Longitudinal section of the holotype. University of Queensland, No. A.14. O. A. Jones collection. Section No. S61.

Favosites nitida Chapman.

Fig. 4.—Transverse section of a paratype. National Museum, No. R.12921.

Fig. 5.—Longitudinal section of the same.

Favosites goldfussi d'Orbigny.

Fig. 6.—Transverse section of the specimen figured by Etheridge (1899, pl. xxxiii, figs. 1, 2). Australian Museum, No. F.4291.

PLATE XIV.

Favosites goldfussi d'Orbigny.

Fig. 1.—Longitudinal section of the specimen figured by Etheridge (1899, pl. xxxiii, figs. 1, 2).

Favosites salebrosa Etheridge fil.

Fig. 2.—Transverse section of the lectotype. Australian Museum, No. F.4288.

Fig. 3.—Longitudinal section of the lectotype.

Fig. 4.—Transverse section of a specimen from Moore Creek. Australian Museum, No. F.6772.

Fig. 5.—Longitudinal section of the same.

Fig. 6.—Longitudinal section of a specimen from Clear Hill, Taemas. University of Queensland, No. F.334. O. A. Jones collection. Section No. Q38.

PLATE XV.

Favosites basaltica (Gold.) var. *moonbiensis* Eth. fil.

Fig. 1.—Transverse section of a specimen from Beedle's Farm, near Moonbi. Australian Museum, No. M.575.

Fig. 2.—Longitudinal section of the same.

Favosites bryani, sp. nov.

Fig. 3.—Transverse section of the holotype. Australian Museum, No. F.5550.

Fig. 4.—Longitudinal section of the holotype.

Fig. 5.—Transverse section of a specimen from Taemas. University of Queensland, No. F.336. O. A. Jones collection. Section No. Q41.

Fig. 6.—Longitudinal section of the same. Section No. Q42.

PLATE XVI.

Favosites multitabulata Eth. fil.

Fig. 1.—Transverse section of a specimen from Nemingha. University of Queensland, No. F.333. O. A. Jones collection. Section No. Q23.

Fig. 2.—Longitudinal section of the same. Section No. Q24.

Favosites murrumbidgeensis, sp. nov.

Fig. 3.—Transverse section of the holotype. Australian Museum, No. F.9576.

Fig. 4.—Longitudinal section of the holotype.

Favosites sp., sp. nov.?

Fig. 5.—Transverse section of the specimen in the British Museum, figured by Etheridge, junr., as *Favosites gothlandica*. Fossil No. R.25922.

Fig. 6.—Longitudinal section of same.

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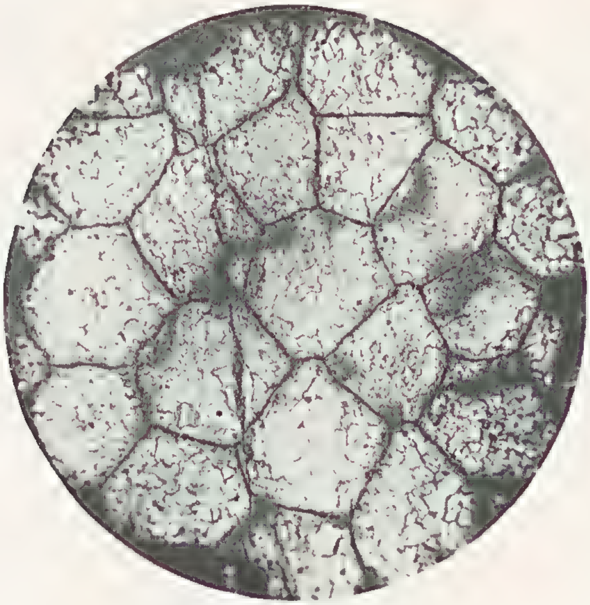

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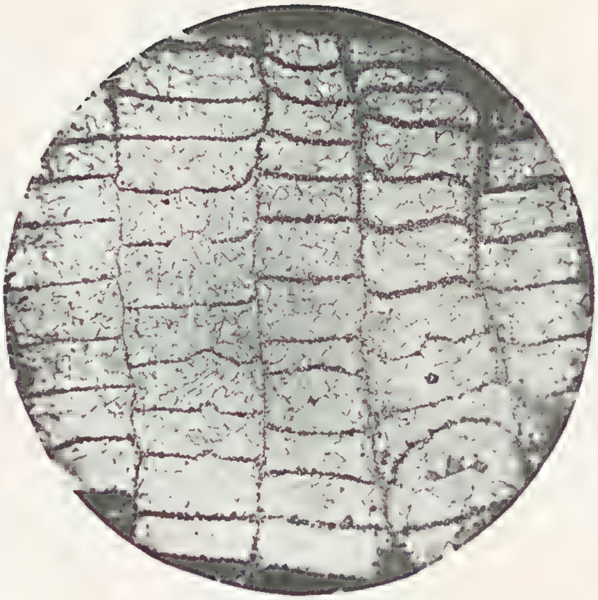

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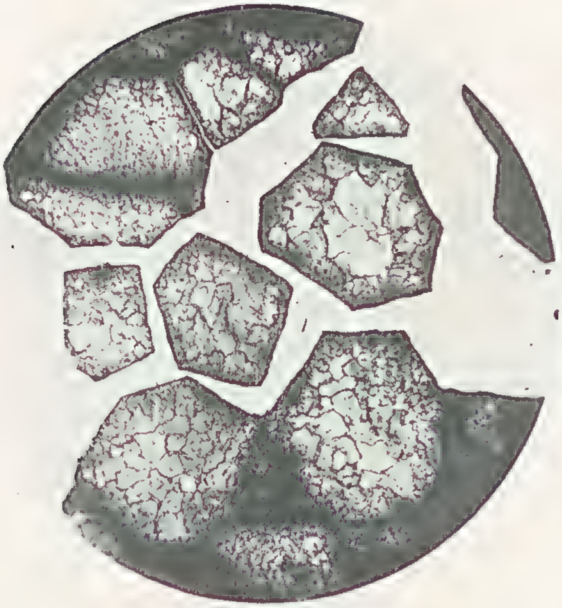

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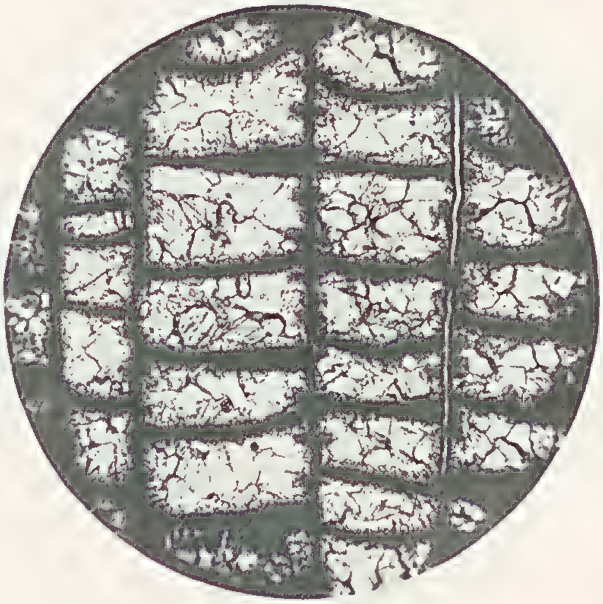

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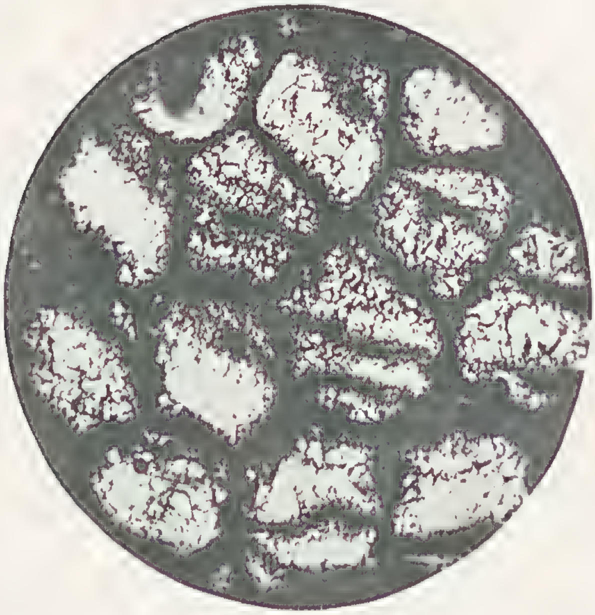

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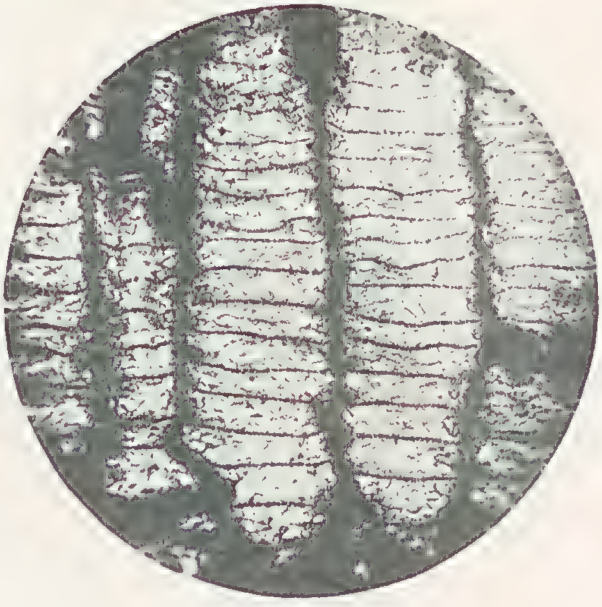

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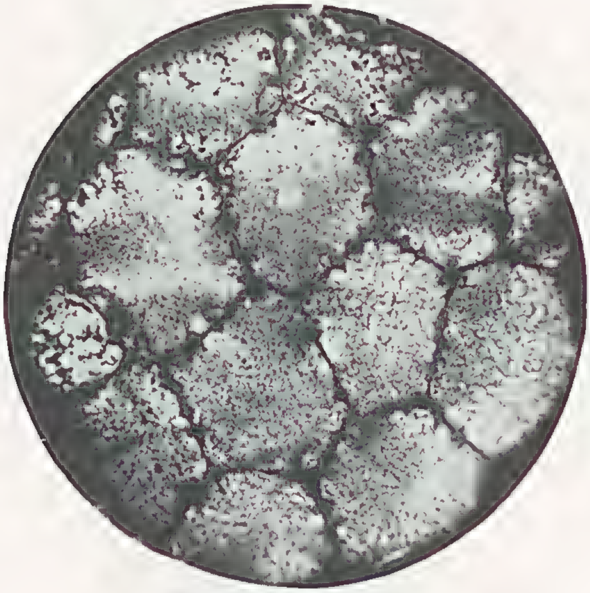

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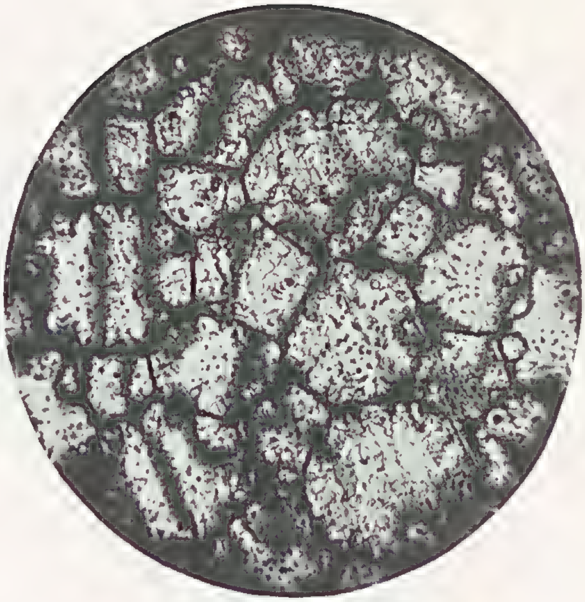

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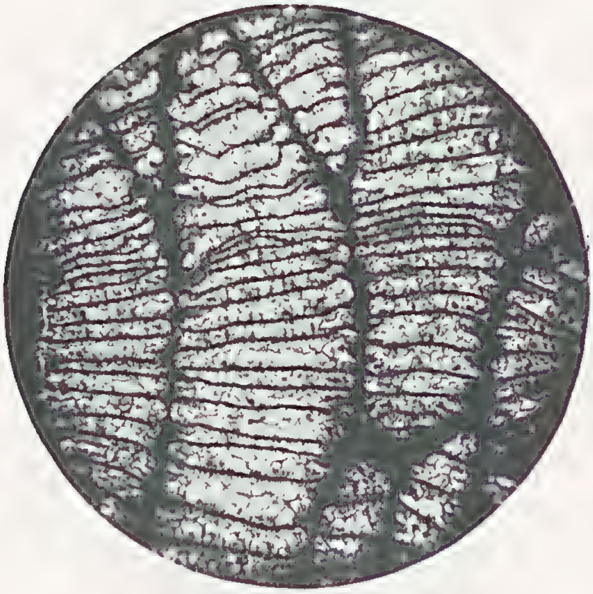

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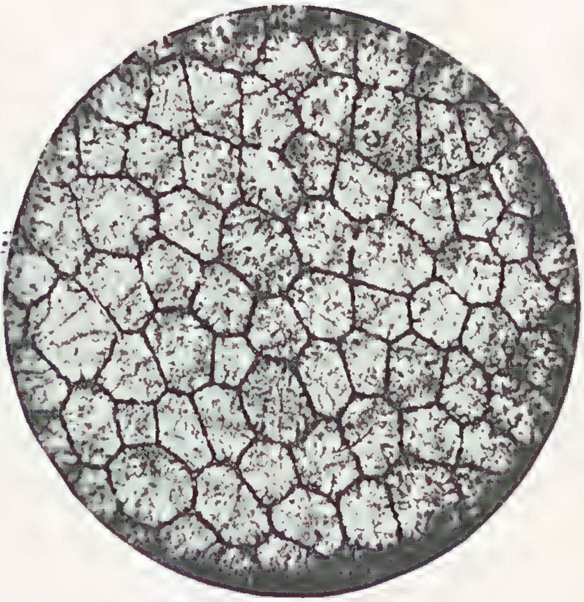

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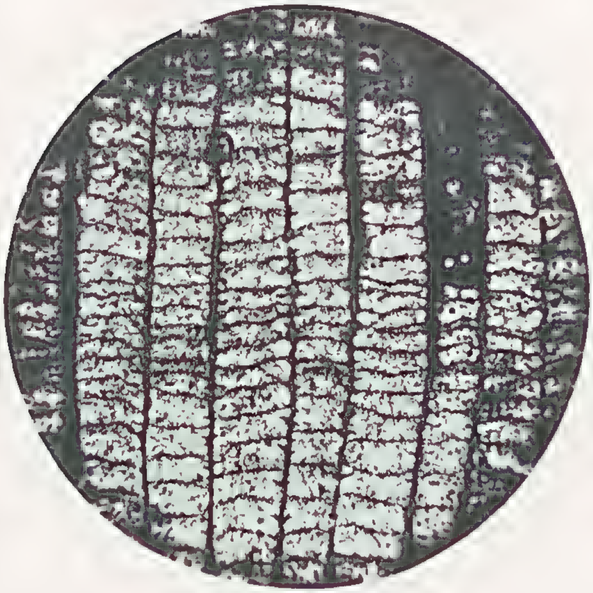

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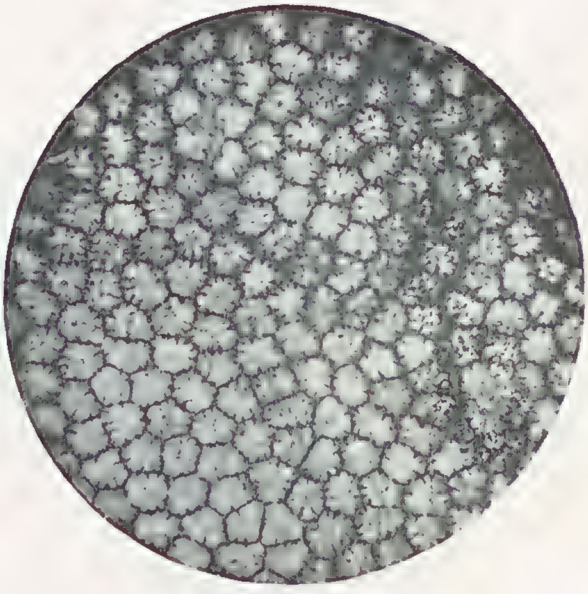

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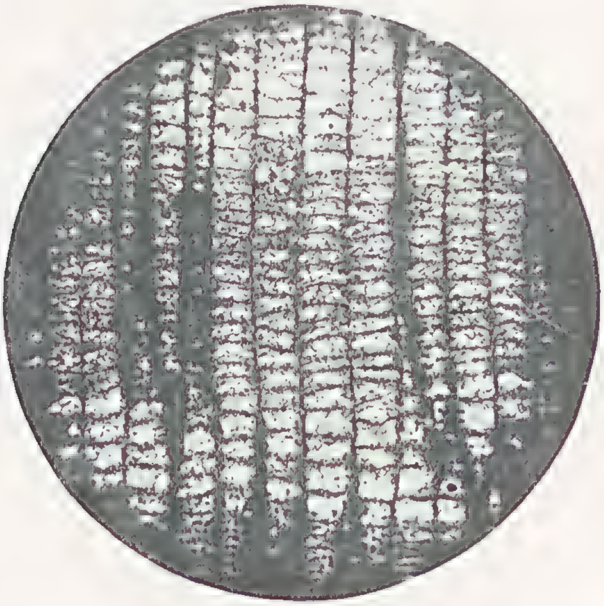

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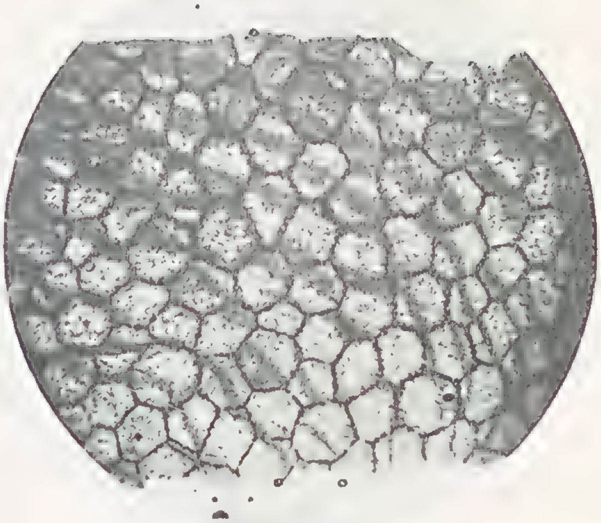

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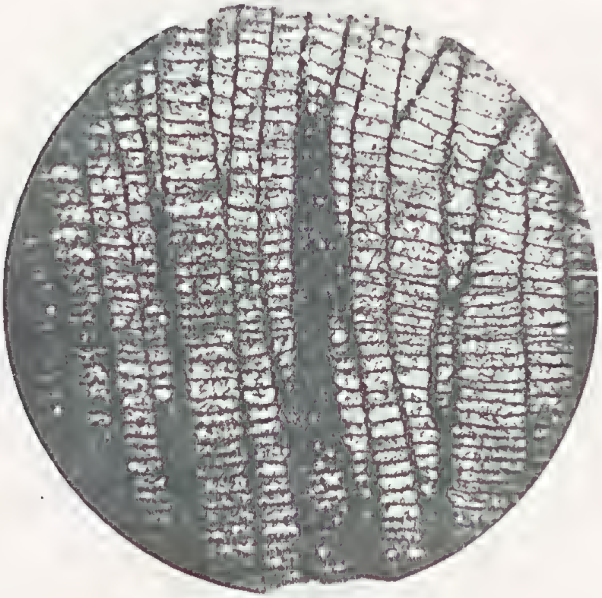

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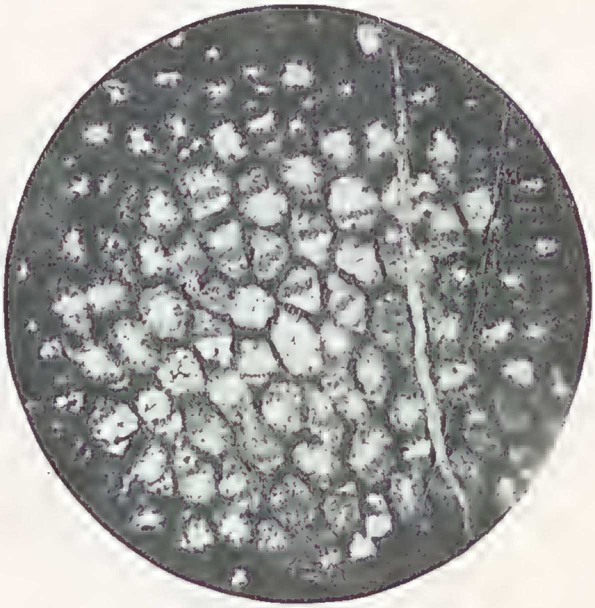

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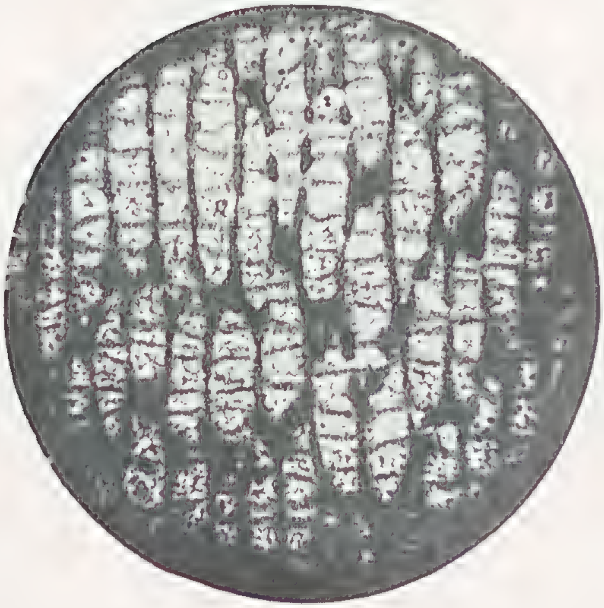

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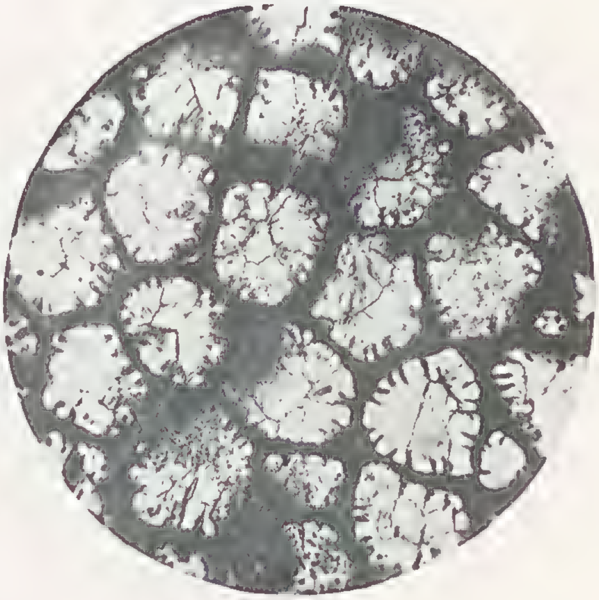

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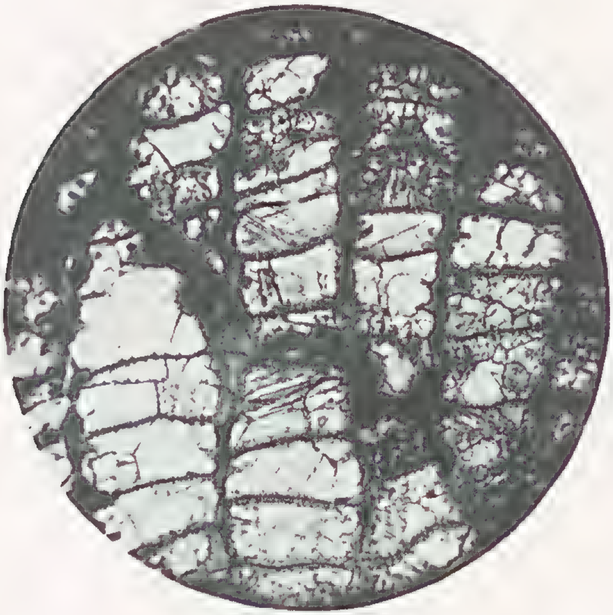

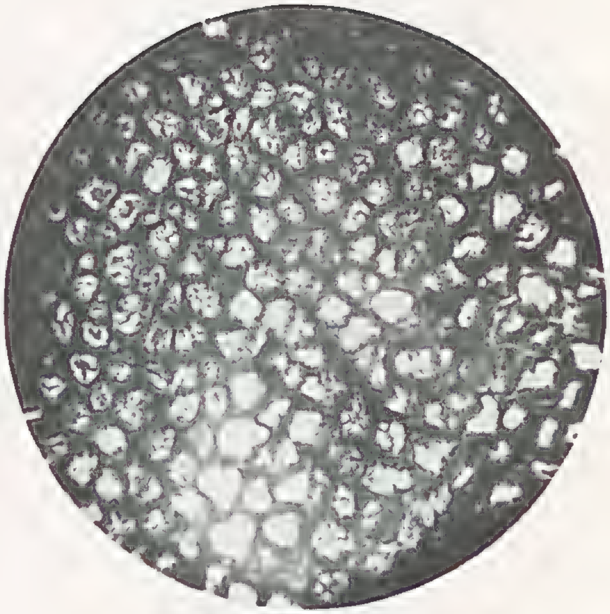

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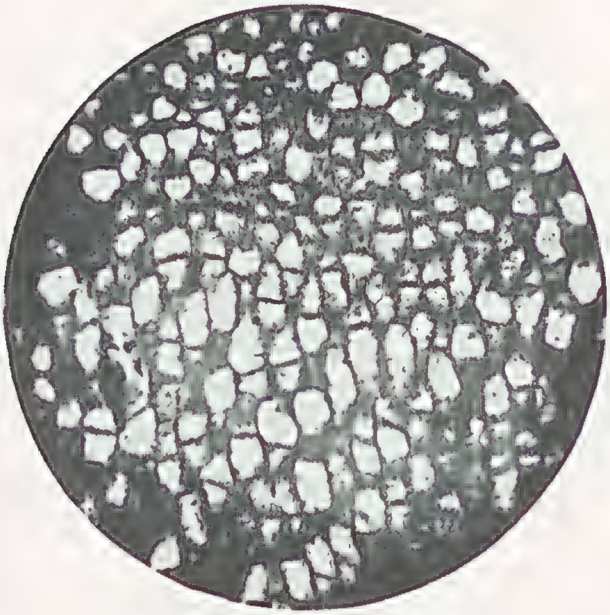

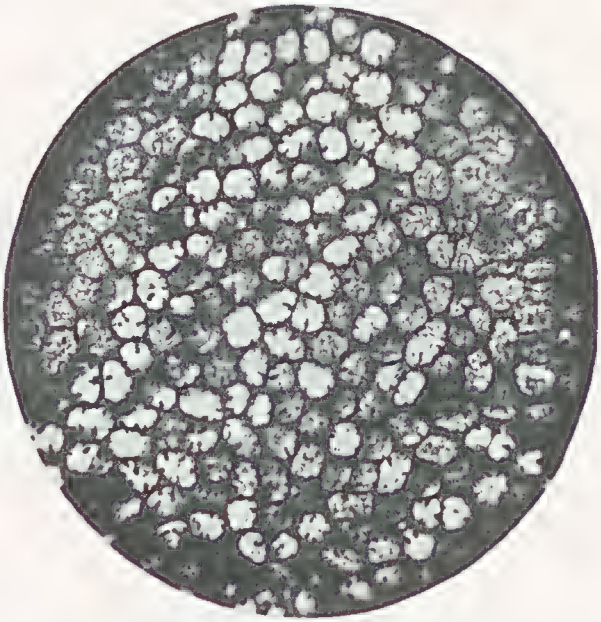

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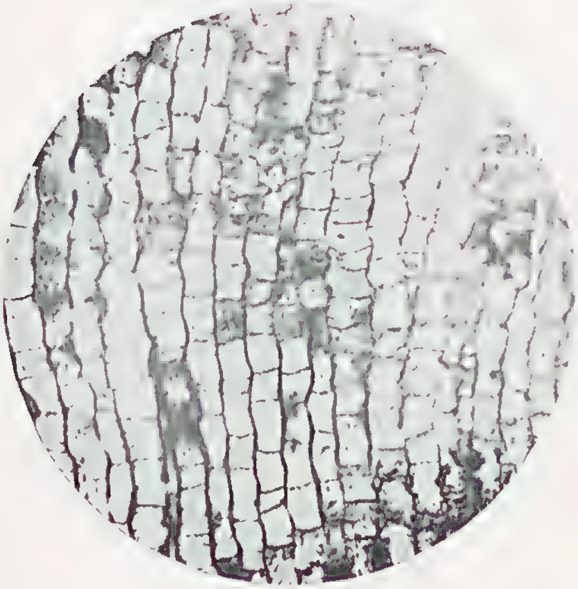

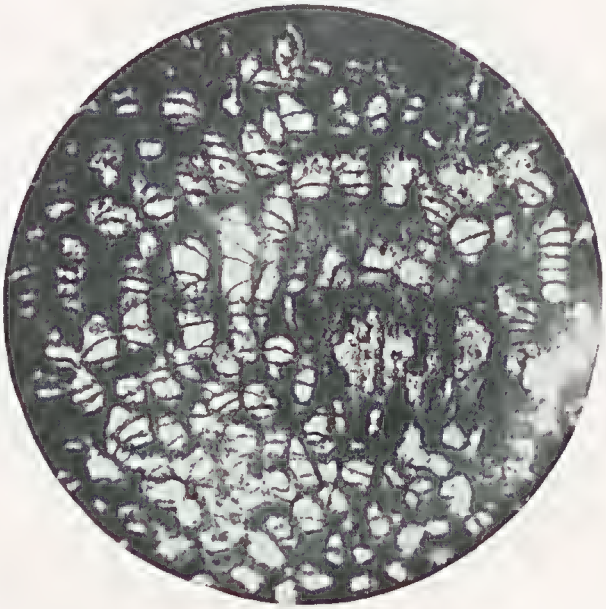

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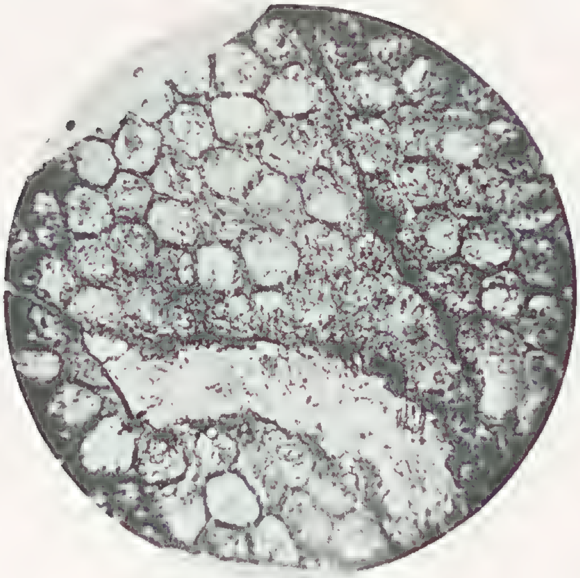

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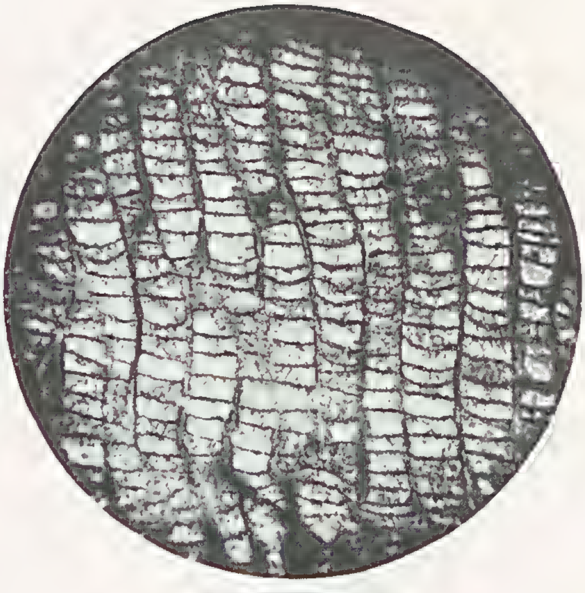

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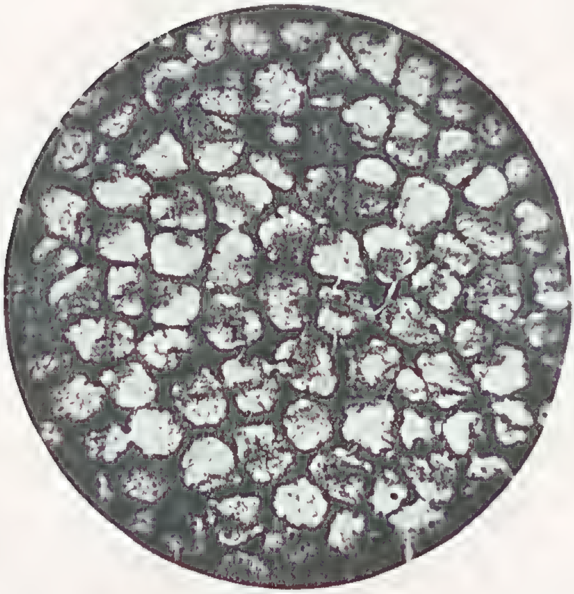

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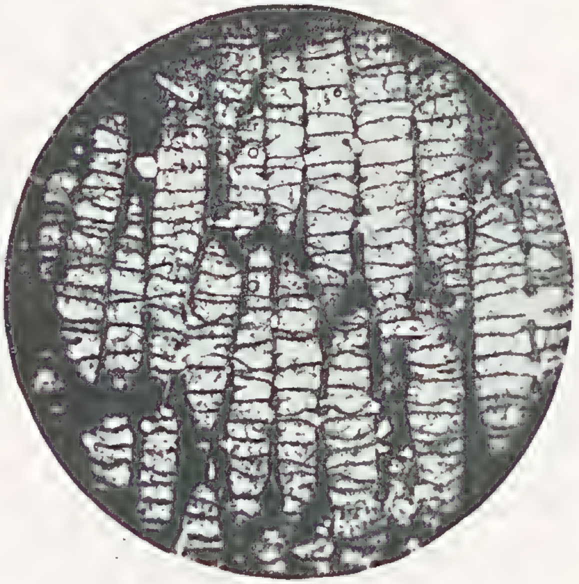

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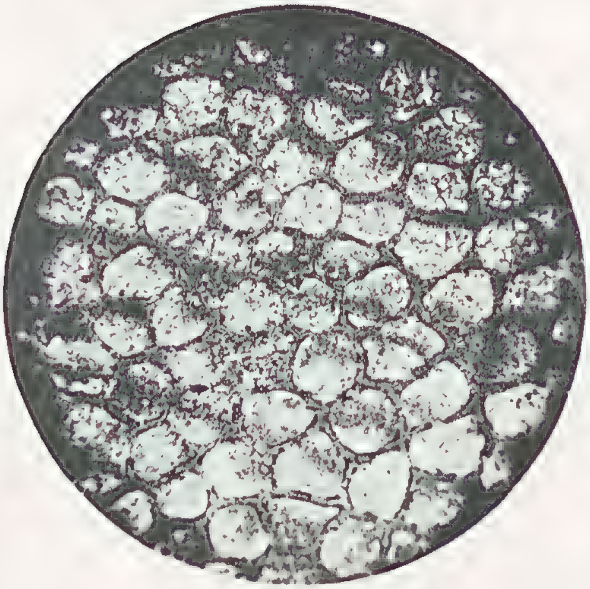

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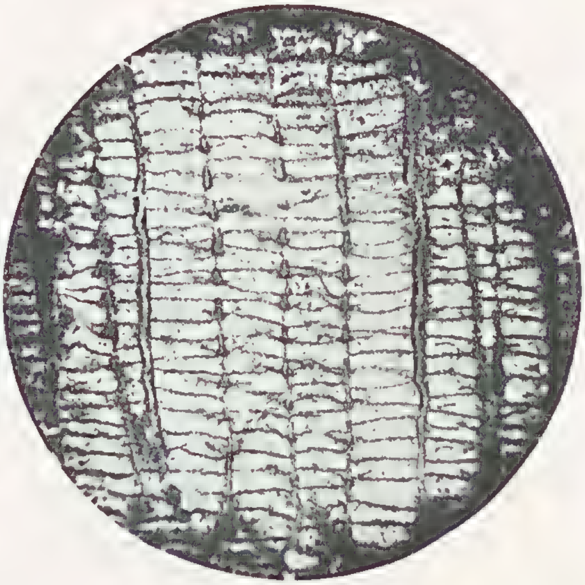

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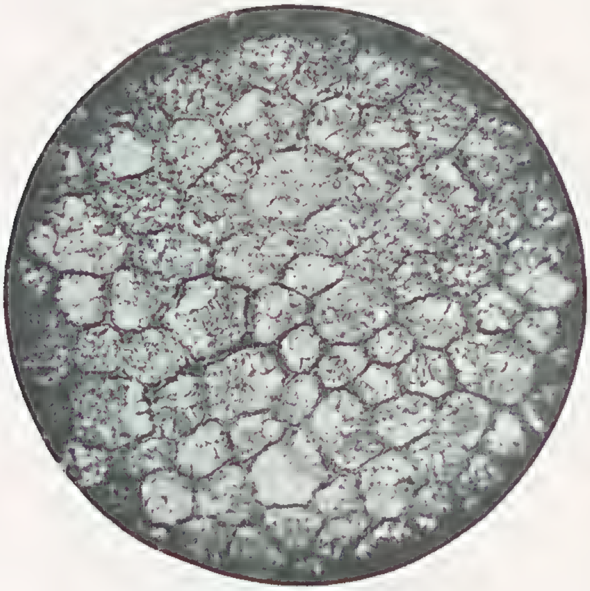
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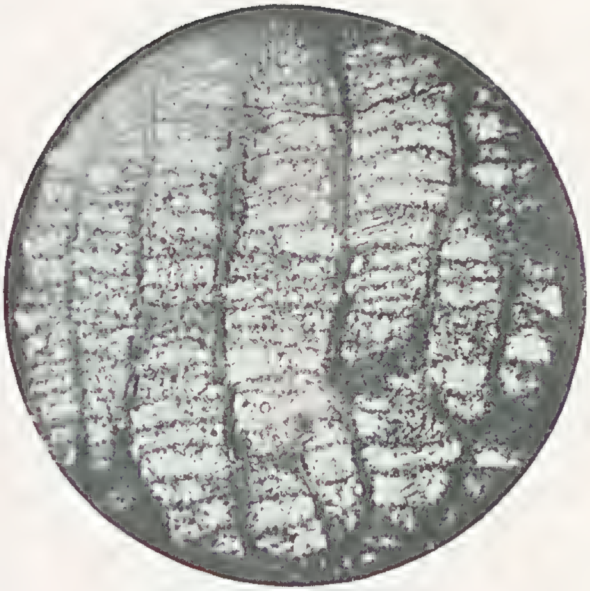
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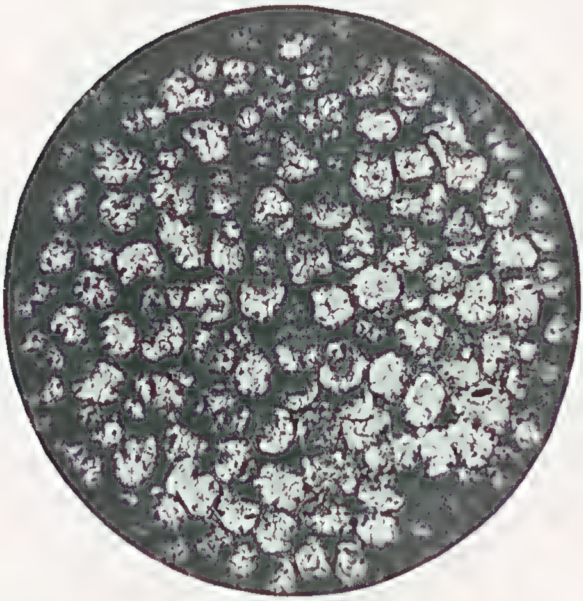
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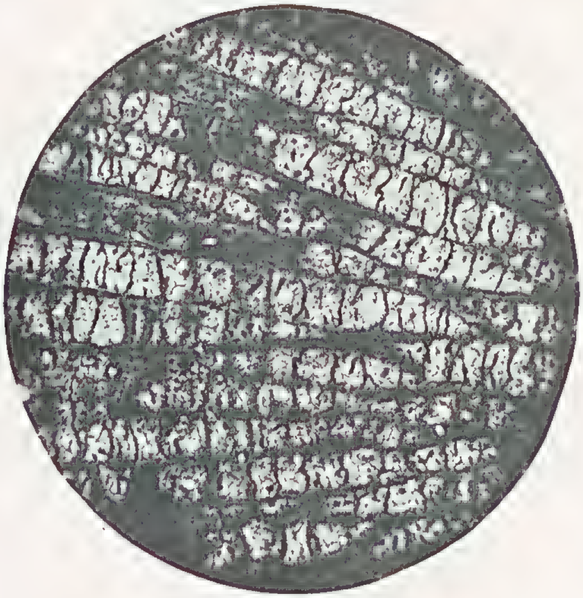
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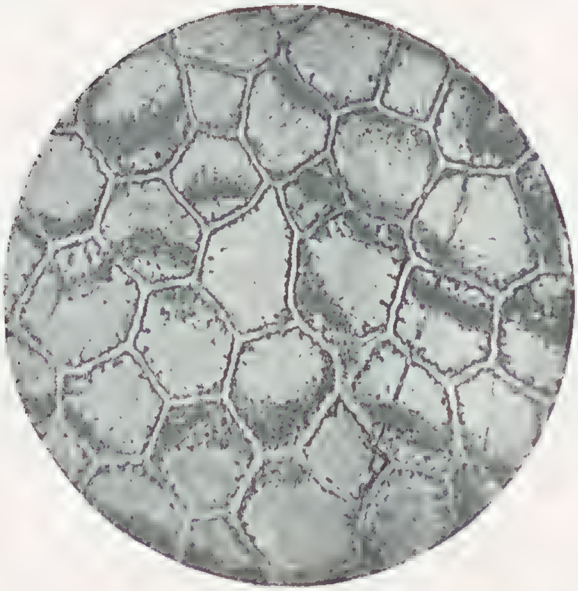
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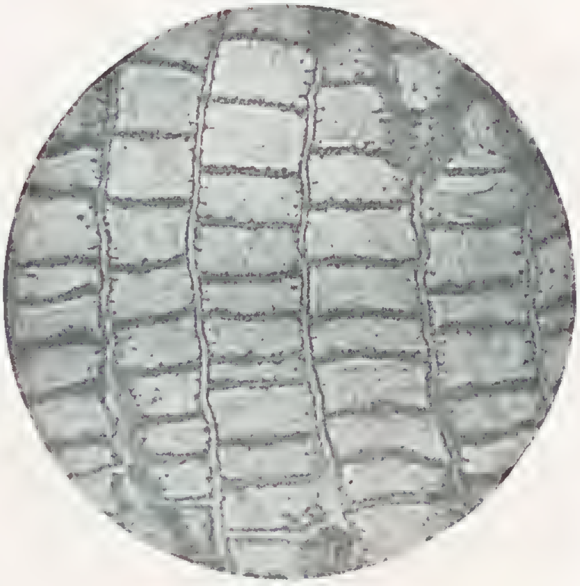
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NOTES ON NEOZELANIC DEEPWATER MARINE MOLLUSCA.

By

TOM IREDALE,
Conchologist, The Australian Museum.

(Plate xvii.)

CAPTAIN C. W. OSTENFELD, of the U.S.S. "Kalingo", regularly visiting the West Coast of the South Island of New Zealand, has brought to this Museum many interesting objects of natural history. The marine Mollusca are of value, as so little comparatively is known from that locality. However, when he observed that trawling was being carried out, twelve miles off Greymouth, on a bank of shallow depth (about 18 fathoms), the importance of the Mollusca from such a location was impressed upon him. Captain Ostenfeld has secured specimens, and it is with great gratitude that these notes are offered, as comparison may later be more completely made, with better material, with the known faunula of the East Australian Continental Shelf. Trawling has been carried on spasmodically for some forty years in the latter locality, regularly more recently, but still there is much to learn about the Mollusca. The trawling crew members are too busy commercially with fish to pay much attention to Mollusca, and therefore only the very prominent shells are commonly secured. A few trawling captains, such as Smith, Howell, and Möller, have collected smaller shells with very gratifying results.

For the past twenty odd years trawling has been carried out on the East Coast of New Zealand, and many large molluscs have been reported upon by Finlay, Powell, Marwick, and Bucknill. These have been of a similar facies to those of East Australia, with, however, notable distinctions.

Thus, broadly speaking, from East Australia huge Tun shells, massive volutids, false-Helmets, Australwhelks and Carrier shells are commonly secured, and all these have been recorded from Neozelanic waters; but in the case of the volutids a different series is represented. Then, of course, in the latter case the local Struthiolarioids occur, as well as the large Calliostomoid forms, the latter being equalled by *Astele* in East Australia. Again the notable Australian umbilicate cowry, *Umbilia*, is still unknown in New Zealand. A pleatless volute, *Iredalina*, has been recorded from New Zealand, and this is unparalleled in Australian waters up to date. Captain Ostenfeld, however, brought in a huge *Ranella*, a form quite unknown here, but which had been recorded previously from eastern New Zealand. This incited the present note, as it is very similar in general appearance to the well-known Mediterranean shell, known as *Ranella gigantea* Lamarck. I here describe the West Coast shell as

Ranella ostenfeldi, sp. nov.

(Plate xvii, fig. 1.)

Shell large, whorls eight, protoconch missing, varicose, whorls rounded, nodulose, spire long, mouth round, anterior canal long for this family.

Coloration brown, mottled with white, periostracum destroyed by extraneous growth, but a few small patches show it to have been brown, very finely setose throughout. Varices irregularly alternate, about two to a whorl and a quarter; rather narrow and upstanding. Sculpture beginning with about three rows of prominent nodules, but the one above the periphery becomes dominant, the others disappearing, and on the last half whorl this also vanishes. A fine concentric ridging continues throughout the shell; on the last half whorl five to ten are more prominent than the others, which number four or five between each notable one, the basal ones generally more marked. The mouth is much more rounded than in any other member of the family, the outer lip strongly straightly expanded, showing on its inner edge a series of marked small nodules. The interior of the mouth is smooth. The columella is a little curved, at its anterior extremity, bearing a ridge which is succeeded by four or five others along the entrance to the anterior canal. The inner lip is strongly reflected as a thick glaze, which stands off the body whorl and continues half-way down the anterior canal. Posteriorly it meets the outer lip and at the junction there is a strong parietal nodule opposed to the inner ending of the outer lip. The canal is long, little curved. The operculum is thick, horny, suboval, nucleus at the lower right edge, *i.e.*, subterminal.

Length, 175 mm.; breadth, 90 mm.

Note.—Bucknill[1] described *Mayena multinodosa* from near Whangaroa, North Island, shell taken from crayfish pots set in 25 fathoms. This was transferred by Finlay to *Fusitriton*, but Powell[2] recognized its affinity correctly, and placed it under *Ranella* s. str. (type *gigantea* Lam. = *olearia* Linné), giving figures of the radula.

The species here described differs at sight in the suppression of the nodulous sculpture seen in Bucknill's species and the development of a strong supraperipheral row of pointed nodules on the early part of the last whorl.

Genus **Alcithoe**.

1853. *Alcithoe* H. and A. Adams, Gen. Rec. Moll., Vol. i, p. 164, Nov. Logotype, Suter, Man. N.Z. Moll., p. 444, 1913, *Voluta pacifica* Solander = *arabica* Gmelin.

Marwick[3] published an excellent essay on the Tertiary and Recent Volutidae of New Zealand, and the shells of this group secured by Captain Ostenfeld have proved of great interest. Some specimens agreed generally with Marwick's plate 68, figs. 2 and 3, representing *jaculoides* Powell[4] and *arabica* Martyn, but with a longer spire. The generic features are the strong sculpture, pleating of the pillar-lip, which is strongly reflexed, and the somewhat narrow elongate mouth strongly callused posteriorly. Other specimens agreed better with Marwick's pl. 63, fig. 4, *A. swainsoni* Marwick, and may be regarded as congeneric, though the sculpture is weaker. However, a series differs in each character, the sculpture being suppressed, the spire narrower, the pleats fewer and stronger, the inner lip appearing only as a broader thin glaze, and the outer lip broadly roundly expanded, with no posterior callus. This is, superficially, genetically related to Marwick's pl. 63, fig. 6, *Alcithoe larochei*, but is specifically separable in its longer spire and different form.

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[1] Bucknill.—*Trans. New Zeal. Inst.*, lviii, p. 312, pl. 35, fig. 2, Nov. 8-15, 1927.
[2] Powell.—*Trans. New Zeal. Inst.*, lxiii, p. 162, Feb. 28, 1933.
[3] Marwick.—*Trans. New Zeal. Inst.*, lvi, pp. 259-303, pls. 61-70, March 13, 1926.
[4] Powell.—*Proc. Mal. Soc.* (Lond.), xvi, p. 108, figs. 1-2, 1924.

Marwick placed *Voluta lutea* Watson in the genus *Waihaoia*, subgenus *Pachymelon*, but all the other members of the genus were non-existent in the Pliocene, the type of the genus being an Eocene shell, and the type of the subgenus early Miocene, so that revision seemed necessary. Finlay[5] thereupon introduced *Palomelon*, and this may be the deeper water representative, but unfortunately the type is unique in the British Museum, so autoptical reconsideration is impossible.

Swainson's *Voluta gracilis*[6] appears to represent another group, the small size, form, pleating, mouth and sculpture differing, so that at least a distinct subgeneric name may be proposed, *Leporemax* nov. The specific name must be emended to *fusus* Quoy and Gaimard,[7] as Swainson's name dates only from 1835, not 1821 as Suter gave it, and it had been used by Dillwyn in 1823,[8] and, moreover, Quoy and Gaimard's name was issued in 1833. Another subgeneric name is needed for *Fulguraria hedleyi* Murdoch and Suter,[9] the small size, narrow shape, elongated spire and narrow compressed mouth being in discord with the previous form, the teeth being also weak; the new name *Carolluta* is introduced, *F. hedleyi* being named as type.

Genus **Gilvostia** nov.

Type **G. ostenfeldi** nov.

Shell large, spire lengthened, narrow, smooth, protoconch small, of two whorls, semi-keeled, four strong folds on columella, mouth wide open, outer lip well curved, with no medial depression, inner lip as broad glaze only, not reflected, no posterior apertural callus.

It has a deceptive resemblance to the Australian *Mesericusa sowerbyi*, the folds of which are only three and longer, while the protoconch in the latter is larger and not keeled, and thus of different origin. If the protoconch features were ignored, this might be regarded as a subgenus only, and Thiele,[10] ignorant of the many complications in connection with Austro-Neozelanic volutes, actually made *Ericusa* (s.l.) a section only of *Alcithoe*.

Gilvostia ostenfeldi, sp. nov.

(Plate xvii, fig. 2.)

Shell large, thin, whorls six, body whorl comprising the bulk of the shell, breadth less than half its length. Spire thin, attenuate, about one-third the shell's length, spire angle about 30°.

Coloration obscured by dark red deposit, but apparently not strongly marked, as no markings appear under the glaze. Sculpture apparently only growth lines, no plications being seen on any specimen, protoconch agreeing with Marwick's fig. 1*b*. Adult whorls rather flattened, sutures not much impressed, last whorl swollen, moderately convex. Aperture large, open, outer lip well curved, with no medial sinuation, and posteriorly not heavily callused. The edge of the outer lip a little reflected and sometimes forming a thickened rim, but not a varix. Columella swollen posteriorly, almost straight anteriorly with four strong folds, the anterior one smallest, the posterior one about half-way up the aperture. Anterior canal broad and rather shallow. Inner lip seen as a broad glaze extending well over the body whorl, but never forming a ridge. No fasciole developed.

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[5] Finlay.—*Trans. New Zeal. Inst.*, lvii, p. 432, Dec. 23, 1926/Mch. 10, 1927.

[6] Swainson.—Exotic Conch., pt. vi, pl. 42, 1835; *cf.* Sherborn and Reynell, *Proc. Mal. Soc.* (Lond.), xi, p. 282, 1915.

[7] Quoy and Gaimard.—*Voy. de l'Astrol. Zool.*, ii, p. 627, pl. 44, figs. 7, 8, 1833.

[8] Dillwyn.—*Index Hist. Conch. Lister*, p. 37, 1823.

[9] Murdoch and Suter.—*Trans. New Zeal. Inst.*, xxxviii, p. 288, pl. 23, figs. 20, 21, 1906.

[10] Thiele.—Handb. syst. Weicht., pt. i, p. 348, 1929.

A medium-sized shell is selected as type, measuring 175 mm. in length, 70 mm. in breadth, spire about 50 mm. long. A larger shell measures 195 mm. by 85 mm., and a smaller one 135 mm. by 63 mm., the latter with a very strongly reflected lip. A broken specimen shows the four pleats very well marked the length of the shell, the anterior one being a little closer to the second than the others are to each other. All the true *Alcithoe* (*arabica*) have five or six pleats, which show a tendency to variation in size, two pleats sometimes almost coalescing.

Alcithoe calva Powell[11] agrees generally with this species, but the columella pleating is very different, Powell's species having "six comparatively weak plications", while there is no variation in the four strong folds of *G. ostenfeldi*.

Fusitriton laudandum Finlay.

1926-7. *Fusitriton laudandum* Finlay, Trans. New Zeal. Inst., Vol. lvii, p. 399, pl. 20, fig. 65, separate Dec. 23, 1926, volume March 10, 1927. Off Otago Heads in 40 fathoms, South Island of New Zealand.

A very fine specimen, agreeing with the above in its coarse sculpture, but of large size, measuring 146 mm. in length by 68 mm. in breadth. It is dead, but retains the remains of a fine straw-coloured flaky periostracum.

Charonia capax Finlay.

1926-7. *Charonia capax* Finlay, Trans. New Zeal. Inst., Vol. lvii, p. 397, pl. 20, fig. 67; subsp. *euclioides*, id., ib., p. 398, pl. 29, fig. 68, separate Dec. 23, 1926, volume March 10, 1927. Off Otago Heads in 20 fathoms; subsp. in 40 fathoms, South Island.

Two specimens agreeing better with the species than the variety, the spire about the length of the aperture, the nodulation becoming obsolete on the body whorl, the parietal pleat very pronounced, and obsolete ridging visible on the columella beneath the glaze. Length, 160 mm.; spire, 75 mm.; breadth, 86 mm. (larger specimen).

Austrofusus glans Bolten.

1798. *Drupa glans* Bolten, Mus. Bolten, pt. ii, p. 56, Sept., for Chemn. 10, t. 163, f. 1558. "New Zealand."

Three beautiful living specimens are clothed with a fine grey-brown periostracum, the nodulation showing through as white. These did not agree with the common shell as seen in this Museum, but Finlay[12] separated the northern and southern forms, giving figures. He regarded the Wellington shells (figs. 4, 5) as typical, and named Dunedin shells as a subspecies, *A. g. agrestior* (figs. 1, 3,

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[11] Powell.—*Trans. New Zeal. Inst.*, lviii, p. 362, pl. 53, figs. 5, 6, Aug. 30-31, 1928.

[12] Finlay.—*Trans. New Zeal. Inst.*, lvii, p. 411, 486, pl. 24, figs. 1, 3, 4, 5; pl. 25, figs. 11, 12, March 10, 1927.

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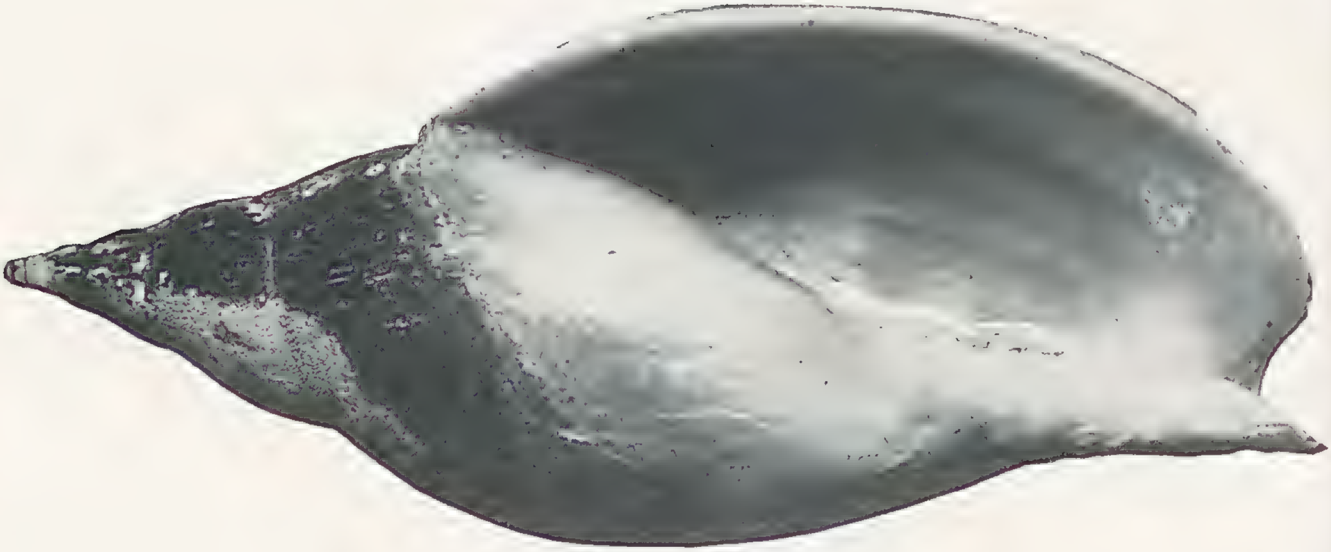

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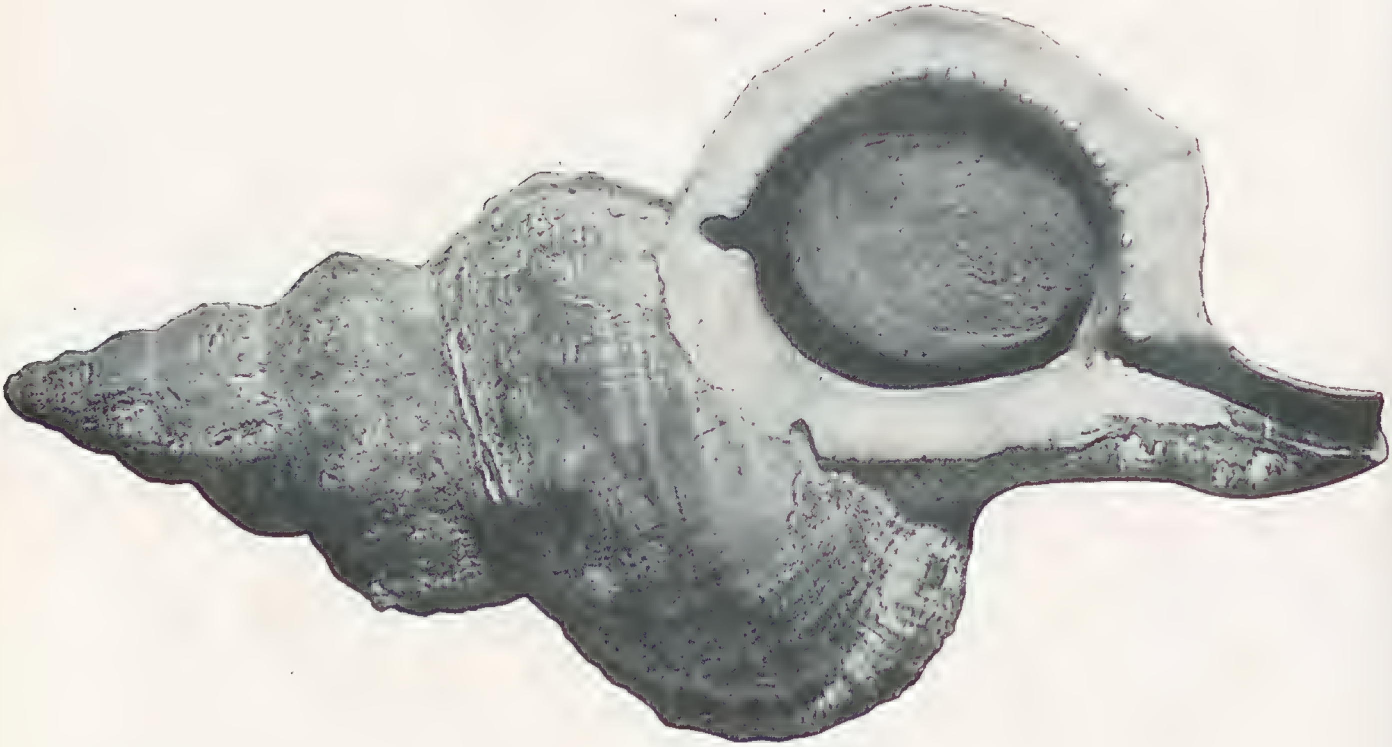

G. C. CLUTTON, photo.

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11, 12), being larger and more elongate, etc. Chemnitz's figure is, however, more like the latter than the former, but obviously it could not be identical. It may have been collected in Queen Charlotte Sound. Finlay[13] has since named the Chatham Island form *A. chathamensis*, drawing attention to Lesson's *Buccinum triton*, which Hutton had first used and then rejected as Peruvian. This was correct, as Lesson himself corrected his mistake writing "excessively common at Callao".

The trawled shells have the double row of nodules persistent the whole length of the body whorl, and while generally agreeing with Finlay's figs. 4 and 5, may be separated on that account as *A. g. tragulatus*, subsp. nov., the measurements being 50 mm. in length by 30 mm. in breadth.

Verconella ormesi Powell.

1927. *Verconella ormesi* Powell, Trans. New Zeal. Inst., Vol. lvii, p. 555, pl. 29, figs. 15, 16, 17, separate Feb. 8, 1927, volume March 10, 1927. 50 to 60 fathoms off Cape Campbell, north-east of South Island.

A large dead shell, inhabited by a hermit crab, measured 155 mm. in length, and 68 mm. in breadth, the protoconch missing. It appears to be a little smoother, the whorls a little more rounded, and the longitudinal ribbing is almost completely obsolete, when compared with the typical series.

EXPLANATION OF PLATE XVII.

Fig. 1.—*Ranella ostenfeldi* Iredale.
Fig. 2.—*Gilvostia ostenfeldi* Iredale.

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[13] Finlay.—*Trans. New Zeal. Inst.*, lix, p. 253, pl. 42, figs. 60-63, August 31, 1928.

NOTES ON AUSTRALIAN CERAMBYCIDAE.

II.

Notes on the Genus *Syllitus*, with Descriptions of New Species.

By

KEITH C. MCKEOWN,
Assistant Entomologist, The Australian Museum.

(Plates xviii–xix.)

The genus *Syllitus* forms a small but extremely interesting group of the Cerambycidae, which on account of the small size and dull coloration of its members appears to be generally overlooked and neglected by collectors, and there is little doubt that systematic collecting would add considerably to the number of known species.

Although the insects are mostly of small size and sombre coloration when viewed with the naked eye, a microscopic examination reveals them to be of considerable beauty, diverse in the arrangement of the raised costae and the sculpture of the elytra.

The genus *Syllitus* was founded by Pascoe in 1858 (*Trans. Ent. Soc. Lond.* (N.S.), v, p. 24) for the reception of *Stenoderus grammicus*, *S. deustus*, and *S. rectus*, all of which had been described by Newman. Pascoe considered that these species were "so different, yet so closely allied to each other, that their separation as a distinct group is advisable. I propose for it, therefore, the name of *Syllitus*; technically it may be at once distinguished from *Stenoderus* by its large oblong entire eyes." Later, in 1862 (*Journ. Ent.*, i, 5, April, 1862, p. 366), he amplified this diagnostic character, and stated that: "I proposed to separate, under the name of *Syllitus*, those species of *Stenoderus* with elevated longitudinal lines on the elytra, from the ordinary red and black ones which constituted the genus originally." Further, in 1864 (*Trans. Ent. Soc. Lond.*, iii (3), 1864–69, p. 554–5), he added that, with one exception—*S. albipennis*, from Morty—the eyes were "coarsely granulate", a character which holds good for the known Australian species.

The affinities of *Stenoderus* and *Syllitus* are undoubtedly very close, and their separation is somewhat arbitrary, as is the case with other Cerambycid genera, yet they fall into two convenient and recognizable groups, so that the distinction may be permitted to remain on the ground of expediency and the lack of more satisfactory generic characters upon which the separation could be based.

Species.

The genus *Syllitus* included seventeen species, a number which the present paper increases to twenty-three, *viz.*:

Genus **Syllitus** Pascoe, 1858.

bipunctatus Waterhouse, 1877.
deustus (Newman), 1841.
fulvipennis Gahan, 1893.
grammicus (Newman), 1840.
heros Blackburn, 1900.
microps Blackburn, 1900.
parryi Pascoe, 1862.
rectus (Newman), 1841.
tabidus Pascoe, 1862.
terminatus Pascoe, 1871.
uniformis Blackburn, 1893.
argillaceus, sp. nov.
acanthias, sp. nov.
divergens, sp. nov.
froggatti, sp. nov.
minutus sp. nov.
sinuatus, sp. nov.
adonarensis Jordan, 1894.
albipennis Pascoe, 1864.
papuanus Gestro, 1875.
spinosus Gahan, 1915.
cylindricus Germain, 1899.
pseudocupes Fairmaire and Germar, 1864.

Geographical Distribution.

Syllitus is typically Australasian in distribution, having a wide range throughout Australia and Tasmania, and extending to Papua and Adonara, near Timor. Two species, however, *S. cylindricus* and *pseudocupes*, have been recorded from Chile, a remarkable and unaccountable divergence in the distribution of a homogeneous group, entirely inconsistent not only with that of *Syllitus*, but with that of all its allied genera which form the Tropocalymmatini of Aurivillius (Junk: *Col. Cat.*, pars. 39, 1912). I cannot, therefore, admit these two species as *Syllitus*, and a re-examination is desirable with a view to fixing their true position. Within Australia the distribution of the individual species appears to be wide, few of them having a restricted range. From an examination of material in the Australian and Macleay Museums, Sydney, and the South Australian Museum, it may be concluded that *S. bipunctatus* is restricted to north-west Australia, *fulvipennis* to north-west Australia and Queensland, *tabidus* to Western Australia, and *terminatus* to north and north-west Australia; the other species are dispersed to a greater or less degree over the continent, and occur in a number of States.

Further information regarding distribution will be found in connection with the discussion of the individual species. Further systematic collection is necessary to determine the range of the species more exactly.

With the exception of a fine coloured figure of *Syllitus rectus* Newm., in Lacordaire's "Histoire Naturelle des Insectes: Genera des Coleoptéres" (*Atlas*, t. 88, fig. 4), and a very indifferent coloured figure of *S. grammicus* given by Blanchard (Voy. Pole Sud., *Atlas*, t. 17, fig. 19), none of the Australian species of *Syllitus* has been figured. It has been considered advisable, therefore, to figure all the described species of the genus known to me, in addition to the new forms described in the present paper, in the hope that they will be useful to workers upon the group and aid in obviating the confusion which exists in some collections with regard to several of the species.

Key to Australian Species of *Syllitus*.

1.	Costae concolorous with elytra	4
	Costae contrasting with elytra	2
	Elytra blotched or mottled	3
2.	1st and 2nd costae parallel	7
	1st and 2nd costae divergent	9

3.	Apex of elytra spined	*acanthias*
	Apex of elytra not spined	*sinuatus*
4.	Apex of elytra black	*terminatus*
	Apex of elytra concolorous	5
5.	Lateral margin straight	6
	Lateral margin curved	*minutus*
6.	Costae parallel	*uniformis*
	Costae divergent	*argillaceus*
7.	Suture white	13
	Suture concolorous	8
8.	1st costa longer than 2nd	*rectus*
	1st costa shorter than 2nd	*microps*
9.	White spot at point of divergence	*bipunctatus*
	Without white spot at point of divergence	10
10.	Costae united at apex	11
	Costae not united at apex	11
11.	Costae of same length	*divergens*
	Costae of unequal length	12
12.	1st costa longer than 2nd	(wanting)
	1st costa shorter than 2nd	16
13.	Two discal costae	*deustus*
	Four discal costae	*heros*
14.	2nd costa united (or almost) to suture	*tabidus*
	1st and 2nd costae united at apex	15
15.	Three discal costae	*froggatti*
	Three discal costae and margin	*parryi*
16.	1st costa slightly deflected to suture	*fulvipennis*
	1st costa strongly deflected to suture	*grammicus*

Syllitus bipunctatus Waterhouse, 1877.

(Pl. xviii, fig. 3.)

Syllitus bipunctatus Waterhouse, Ent. Mo. Mag., xiv, 1877, p. 73.

Although this species is usually very easily identified and separated from any of the more closely allied forms, there are several specimens in the Australian Museum cllection in which the white spot within the diverging costae is elongated into a white or cream line of a somewhat transparent nature, and which differ somewhat in other features, but, until further material is available for study, it is not advisable to make a definite decision as to their identity. It is possible that this is the form described as "*Syllitus* sp.?" by Gahan in 1893 (*Trans. Ent. Soc. Lond.*, p. 185) from Roebuck Bay.

The specimens of *S. bipunctatus* in the collection of the Australian Museum are from north-west Australia. The type locality is Queensland.

Syllitus deustus (Newman), 1841.

Stenoderus deustus Newman, Entomologist, i, April, 1841, p. 95.

This species, which is described as being of small size—3/10 inch in length—and having both the suture and the lateral margin white, in addition to the two discal and the humeral costae whitish, and the prothorax fuscous and definitely not ferruginous, is unknown to me. It was apparently unknown also to Blackburn, who suggested that it might possibly be a variety of *rectus*. Several specimens in the Macleay and South Australian Museums are labelled as *deustus*, but in no instance did they fit Newman's description, and in all there was no indication of the white sutural line, which would appear to be a distinctive character of the species.

The type locality for *S. deustus* is vaguely stated by Newman to be "New Holland".

Syllitus fulvipennis Gahan, 1893.

(Pl. xix, fig. 7.)

Syllitus fulvipennis Gahan, Trans. Ent. Soc. Lond., 1893, p. 184.

S. fulvipennis, although close to *S. grammicus*, appears to be a good species; in addition to the characters given in Gahan's description, the puncturation of the elytra appears to be finer than in the latter species.

Specimens in the Australian and Macleay Museums are from Queensland and north-west Australia respectively. Type locality is Cassini, West Australia.

Syllitus grammicus (Newman), 1840.

(Pl. xviii, fig. 7.)

Stenoderus grammicus Newman, Ann. Mag. Nat. Hist., v, 1840, p. 21.

Considerable confusion appears to exist in both museum and private collections between this species and *S. rectus*, and in almost all the material examined both species were mixed under either name, in spite of the fact that these insects are amongst the most easily distinguished members of the genus. Newman's description, although very brief, is clear, and the characters mentioned by him are sufficiently distinctive to ensure their separation being reasonably simple, and the diagnosis agrees closely with the specimens examined. The inner costa, somewhat towards the middle of its length, is deflected towards the line of the suture, while the outer costa bends towards the lateral margin. The inner costa is shorter than the second. The humeral costa is almost concolorous with the elytra, and throughout the greater part of its length lies close to the second white costa. There is little variation in the large series of specimens examined.

This species appears to have a very wide distribution throughout Australia, and specimens in the Australian Museum are from New South Wales, Tasmania, South Australia, Kangaroo Island, and Queensland, while the South Australian Museum has material from North Australia. I have seen specimens from Victoria in private collections. The type locality is Adelaide, South Australia.

Syllitus heros Blackburn, 1900.

(Pl. xviii, fig. 5.)

Syllitus heros Blackburn, Proc. Roy. Soc. Vic., xii, 2, April, 1900, p. 231.

The large size together with the numerous white costae serves to distinguish this species from the closest of its congeners, *S. parryi*, each elytron bearing four costae, as well as white sutural and lateral lines.

The Australian Museum collection contains material from South Australia; the South Australian Museum from South Australia and Queensland; and the Macleay Museum from South and West Australia. The type locality is Quorn, South Australia.

Syllitus microps Blackburn, 1900.

(Pl. xviii, fig. 1.)

Syllitus microps Blackburn, Proc. Roy. Soc. Vic., xii, 2, April, 1900, p. 232.

From Blackburn's description, I was at first inclined to consider this species as a small variety of *S. rectus*, but a comparison of a paratype with a very large series of specimens has convinced me that the specific characters as given are constant, and, although the small eye is not usually a satisfactory factor, once the species has been identified, its separation from its larger congener is comparatively simple. It must be remarked, however, that, working from the description alone, it is difficult to determine such points as "smallness" of eye, etc., yet no other characters present themselves which can be considered useful in aiding identification.

New South Wales, Queensland, and South Australia are represented in the Australian Museum collection; South Australia, Queensland, and Tasmania in the South Australian Museum. Blackburn gives as localities South Australia, Victoria, and Tasmania.

Syllitus parryi Pascoe, 1862.

(Pl. xviii, fig. 8.)

Syllitus parryi Pascoe, Journ. Ent., i, 5, April, 1862, p. 366.

This large and distinct species is represented by specimens from South Australia in the Australian, Macleay, and South Australian Museums; and New South Wales in the South Australian Museum. The type locality is given as "Australia".

Syllitus rectus (Newman), 1841.

(Pl. xviii, fig. 6.)

Stenoderus rectus Newman, Entomologist, i, April, 1841, p. 95.

This species has unaccountably been confused with *S. grammicus* in many collections, and the same error eccurs in Gemminger and Harold's "Catalogus Coleopterorum" (1872), where it is listed as a variety of that species; it is, however, one of the most distinct species of the genus. Its dark brown elytra, each marked with three parallel white costae, of which the second is not as long as the first, render it unmistakable, especially when taken in conjunction with its comparatively large size and robust form.

Its range throughout Australia is wide; the only State from which I have not seen specimens is West Australia, and it is probable that further collecting will reveal its presence in that area. The Australian Museum contains specimens from New South Wales, South Australia, and Queensland; these States are also represented in the South Australian Museum, with the addition of Victoria and Tasmania; those in the Macleay Museum are from Tasmania and North Queensland. The type locality is given by Newman as "New Holland", but Gahan (*Trans. Ent. Soc. Lond.*, 1893, p. 183) states that the type came from South Australia (Davis).

Syllitus tabidus Pascoe, 1871.

(Pl. xix, fig. 3.)

Syllitus tabidus Pascoe, Ann. Mag. Nat. Hist., viii (4), 1871, p. 271.

A slender species of a general stramineous coloration, which appears to be confined to West Australia, the specimens in the Macleay and Australian Museums coming from this locality. Although the ground colour of the elytra in the majority of specimens is consistently pale, a few show a tendency to a slight brownish tint at the apex of the elytra.

The type locality is Nicol Bay, West Australia.

Syllitus terminatus Pascoe, 1871.

(Pl. xviii, fig. 2.)

Syllitus terminatus Pascoe, Ann. Mag. Nat. Hist., viii (4), 1871, p. 271.

This is a very distinct species, remarkable for the black terminal area of the otherwise yellowish elytra, a character which renders it quite unmistakable. The coloration of *S. terminatus* is a quite remarkable deviation from that so consistent throughout the other members of the genus.

Specimens from north-west Australia are in the collections of the Australian, Macleay, and South Australian Museums, and the latter institution also has material from North Australia. The type locality of the species is Nicol Bay, West Australia.

Syllitus uniformis Blackburn, 1893.

(Pl. xviii, fig. 4.)

Syllitus uniformis Blackburn, Trans. Roy. Soc. S. Aust., xvi, 2, June, 1893, p. 197.

This small concolorous species is easily distinguished from its allies by the dark ferruginous colour and the absence of white on the raised elytral costae. *S. minutus*, sp. nov., is close to this species, but is readily separated by the curved lateral margin of the elytra and other characters.

S. uniformis is widely distributed throughout Australia, being represented in the Australian Museum collection from New South Wales and Queensland; in the South Australian Museum from New South Wales, South Australia, and Central Australia. The type locality is Fraser Range, Central Australia. Blackburn also states that he has the species from South Australia.

Syllitus argillaceus, sp. nov.

(Pl. xix, fig. 8.)

Robust: Head and prothorax bright ferruginous. Elytra clay-coloured (Ridgeway, pl. xxix), finely punctate, with suture, three narrow raised costae and lateral margin concolorous; 1st costa approximately parallel to suture, approaching it slightly about midway, 2nd costa diverging in a wide curve for about one-third of its length; 1st costa slightly shorter than 2nd; both costae curving inwards and touching the suture near apex of elytra; humeral costa almost straight, parallel to lateral margin. Elytra tapering, apices divergent and narrowly rounded. Antennae almost reaching extremity of elytra, bright ferruginous. Legs bright ferruginous. Ventral surface ferruginous with a slight greyish pubescence.

Length, 12 mm.

Loc.—Forest Reefs, New South Wales (A. M. Lea).

Holotype in South Australian Museum.

This is the only species of *Syllitus* known to me in which all the elytral costae are concolorous with the elytra, with the exception of *S. uniformis* Blkb., in which the costae are straight, but from this the present species is readily separated by its larger size and more robust form, divergent costae, pale colour, and the much finer sculpture of the elytra.

Syllitus acanthias, sp. nov.

(Pl. xix, figs. 5 and 5*a*.)

Robust: Head and prothorax dull ochraceous, nitid, sparsely and finely punctate. Elytra light brown, with a distinct pale yellowish-white lateral patch on the basal third extending from just before the second costa to the lateral margin; a clearly-defined patch of similar colour extending from midway between the second and the first costa to the suture; these and other small light areas give the insect a somewhat mottled appearance; 1st and 2nd costae parallel, creamy white; 1st costa longer than 2nd, 3rd concolorous with elytra. The apex of each elytron is produced into a single acute but stout spine. Scutellum dark brown, sparsely clothed with a coarse pubescence. Antennae longer than body, dull ochraceous, finely punctate, and covered with a fine golden pubescence; scape of antennae darker and browner with larger and coarser punctures, and the pubescence more sparse than on the rest of the antenna. Legs brown. Ventral surface bright brown, sparsely clothed with a fine grey pubescence.

Length, 14·5 mm.

Loc.—Moa (Banks Island), Torres Strait (W. McLennan); 4 specimens.

Holotype in Australian Museum.

This insect is not only the largest and most robust, but also quite the most striking member of the genus known to me, being even larger and stouter than *S. heros* Blkb. The stout terminal spine of the elytra is also present in *S. albipennis* Pasc., described from Morty, but the present species differs considerably from this not only with regard to its large size and its coloration, but in other respects. *S. albipennis* is known to me only from Pascoe's description (*Trans. Ent. Soc. Lond.*, iii (3), 1864, p. 555).

Syllitus divergens, sp. nov.

(Pl. xix, fig. 6.)

Slender: Head and prothorax brown, rugose, and sparsely punctate. Elytra dark brown, coarsely pitted with large punctures; suture pale stramineous—almost white; 1st and 2nd costae dull white, 3rd concolorous with elytra, lateral margin white; 1st and 2nd costae parallel for about one-third of their length, when they diverge widely and abruptly near the centre of the elytra, then converging again gradually towards the apex. First costa almost reaches the suture at the point of widest divergence, 2nd nearly reaching 3rd; 1st and 2nd costae practically equal in length, but 1st very slightly longer than 2nd. The area bounded by 1st and 2nd costae is much darker in colour than the rest of the elytra; in some specimens almost black. Antennae shorter than body, brown, concolorous, clothed with a sparse, fine, whitish pubescence. Ventral surface brown, densely clothed with fine grey pubescence.

Length, 9 mm.

Loc.—Moa (Banks Island), Torres Strait (W. McLennan); 4 specimens.

Holotype in Australian Museum.

This small and dark species is readily distinguished from others by the very abrupt and wide divergence of the first two elytral costae, and by the almost complete absence of lateral tubercles on the thorax, the sides of which are almost parallel and very slightly rounded.

Syllitus froggatti, sp. nov.

(Pl. xix, fig. 2.)

Relatively stout: Head and prothorax ferruginous. Antennae not reaching extremity of body, ferruginous. Elytra rich dark brown, coarsely punctate, suture narrowly margined with a fine line of stramineous; 1st and 2nd costae comparatively broad, clearly defined, white bordered on both sides with pale stramineous; costae 1 and 2 equal in length, meeting and coalescing at apex so that the elytral area bounded by them is completely closed; 1st costa nearly parallel to the suture, but approaching it almost imperceptibly towards the centre; 2nd costa slightly divergent near centre; humeral costa shorter than 1 and 2, somewhat broadly whitish near its base, but becoming dull stramineous over the latter three-quarters of its length; marginal costa white, comparatively broad and well defined. Scutellum pale ochraceous, broadly rounded. Ventral surface concolorous with ground colour of elytra, slightly pubescent. Legs ferruginous, with short scattered pubescence.

Length, 9 mm.

Loc.—Merriwa, New South Wales (W. W. Froggatt), 15 Nov., 1902; one specimen. Wattle Flat, near Bathurst, New South Wales (W. W. Froggatt); one specimen.

Holotype (Merriwa) in Australian Museum.

This species is readily distinguished from any other known to me by the costae of equal length coalescing at the apex of the elytra, and the stramineous edging to costae 1 and 2.

Syllitus minutus, sp. nov.

(Pl. xix, fig. 1.)

Slender: Head and prothorax pale ferruginous, rugose; head relatively broad. Antennae not reaching apices of elytra, pale ferruginous. Elytra clay-coloured, coarsely punctate at base and apex, finely on median area, with three concolorous raised costae; 1st and 2nd costae widely separated; 1st costa close to and almost parallel with suture, approaching it slightly towards the middle of its length; 2nd costa diverging gradually throughout the greater part of its length, and approaching costa 3, which runs nearly parallel to it; lateral margin with a marked inward curve towards its centre, where it closely approaches costa 3. Legs uniformly pale ferruginous. Ventral surface: sternum pale ferruginous; abdomen black, becoming dark ferruginous towards its extremity.

Length, 5 mm.

Loc.—Cairns, North Queensland (F. P. Dodd).

Holotype in South Australian Museum.

This is the smallest species of *Syllitus* known to me, being only 1/5 inch in length. It is very distinct from its allies, and may be distinguished by its widely separated and slightly diverging concolorous elytral costae, and by the curved lateral margin of the elytra.

Syllitus sinuatus, sp. nov.

(Pl. xix, fig. 4, 4*a*.)

Slender: Head and prothorax nitid, ochraceous, with a broad median brownish-black stripe extending from the apex of the head to the base of the prothorax. Elytra coarsely punctate, yellowish-white, with a very dark brown—almost black—sinuate stripe extending from the humerus to the apex; 1st and 2nd costae parallel, cream; 1st considerably longer than 2nd, 3rd concolorous with elytra; apex of elytra acutely rounded, slightly divergent. Scutellum brown, coarsely punctate, with a slight pubescence. Antennae as long as, or very slightly longer than, body, bright ochraceous, sparsely and finely punctate with coarse and widely scattered sparse hairs. Legs ferruginous, clothed with a dense, fine, white pubescence, concentrated and forming large patches on the lower surface and outer sides of the coxae. Ventral surface pale ochraceous; sternum densely, and abdomen sparsely, clothed with fine white pubescence.

Length, 10 mm.

Loc.—Cairns, North Queensland, three specimens: Moa (Banks Island), Torres Strait (W. McLennan), one specimen; Coen district, Cape York (H. Hacker), two specimens.

Holotype (Cairns) in Australian Museum.

This species bears a superficial resemblance to *S. acanthias*, sp. nov., but it is smaller, and is readily distinguished by the presence of the dark thoracic stripe, the regular sinuate band upon the elytra, and the dense white pubescence upon the coxae, together with the complete absence of the apical spine on the elytra. The coloration is very consistent throughout the series, with the exception of the single specimen from Moa (Banks Island), which is much darker than those from North Queensland.

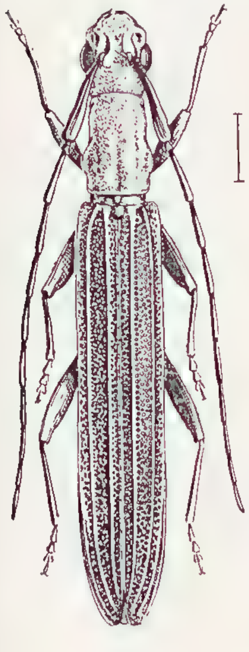
EXPLANATION OF PLATES.

Plate XVIII.

Fig. 1. *Syllitus microps* Blackburn.
Fig. 2. ,, *terminatus* Pascoe.
Fig. 3. ,, *bipunctatus* Waterhouse.
Fig. 4. ,, *uniformis* Blackburn.
Fig. 5. ,, *heros* Blackburn.
Fig. 6. ,, *rectus* (Newman).
Fig. 7. ,, *grammicus* (Newman).
Fig. 8. ,, *parryi* Pascoe.

Plate XIX.

Fig. 1. *Syllitus minutus*, sp. nov.
Fig. 2. ,, *froggatti*, sp. nov.
Fig. 3. ,, *tabidus* Pascoe.
Fig. 4. ,, *sinuatus*, sp. nov.
Fig. 4*a*. ,, ,, Apex of elytra.
Fig. 5. ,, *acanthias*, sp. nov.
Fig. 5*a*. ,, ,, Apex of elytra.
Fig. 6. ,, *divergens*, sp. nov.
Fig. 7. ,, *fulvipennis* Gahan.
Fig. 8. ,, *argillaceus*, sp. nov.



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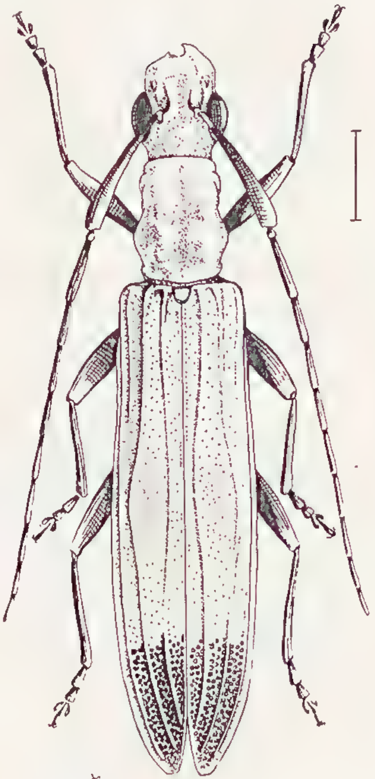

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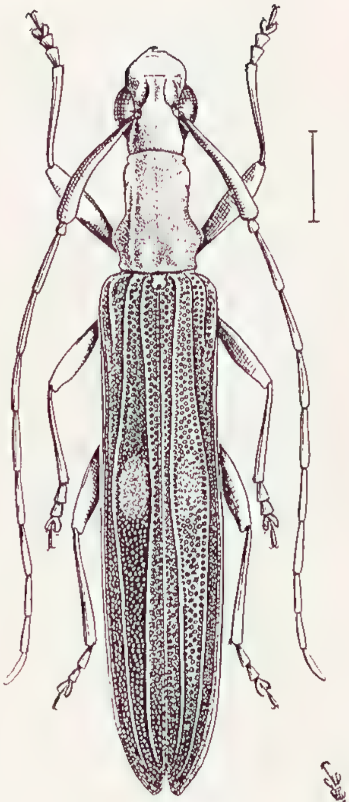

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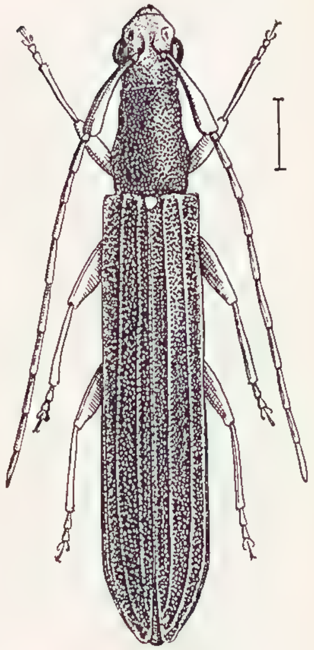

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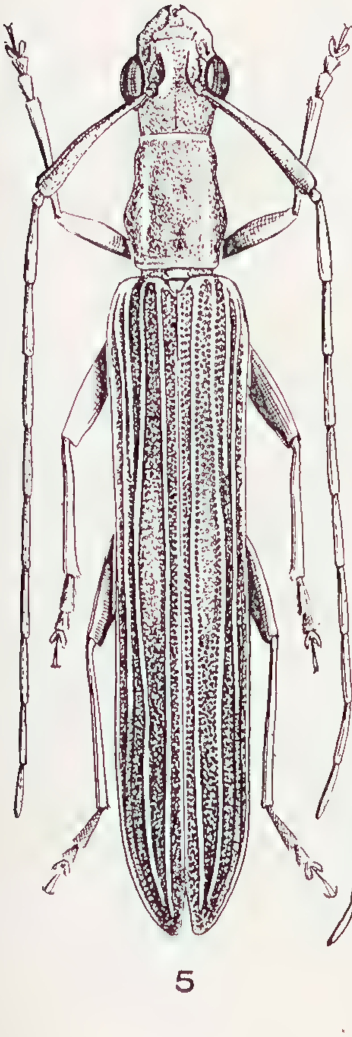

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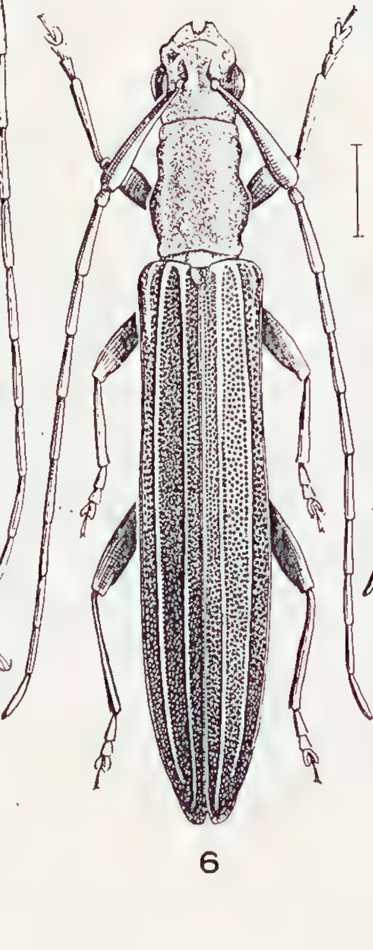

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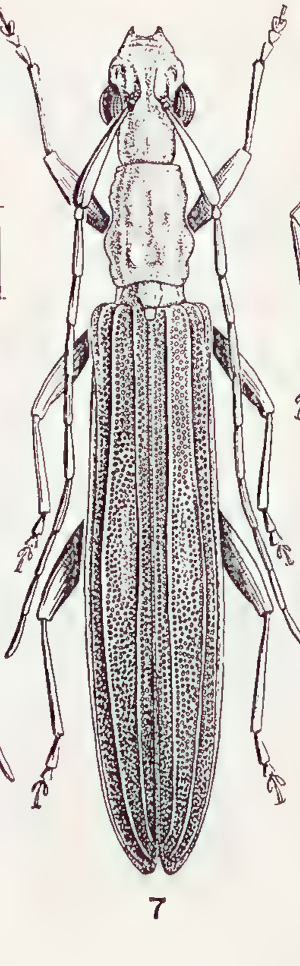

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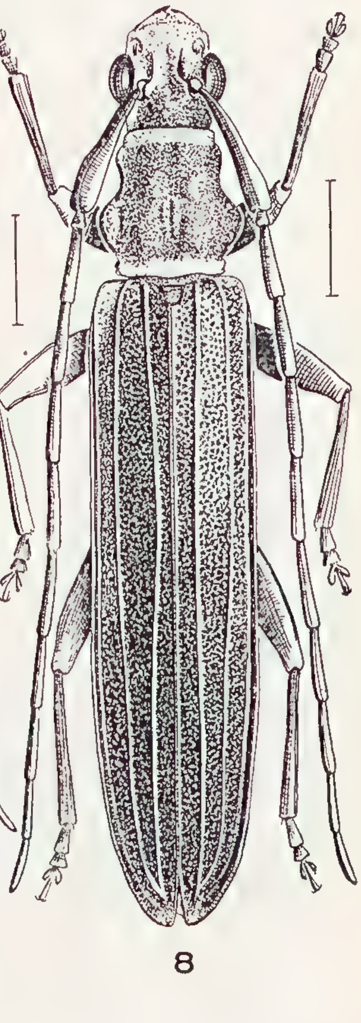

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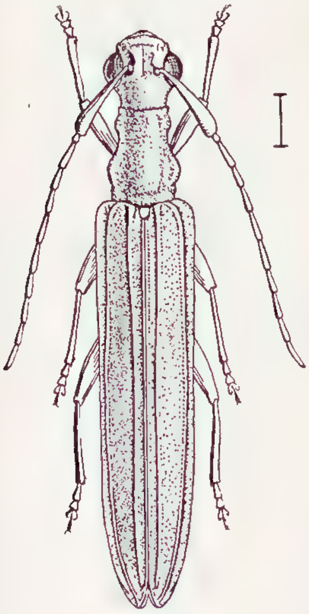
Nancy B. Adams, *del.*

NATIONAL MUSEUM OF VICTORIA



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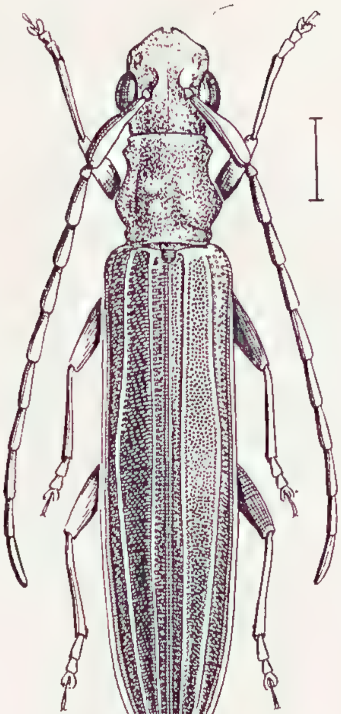

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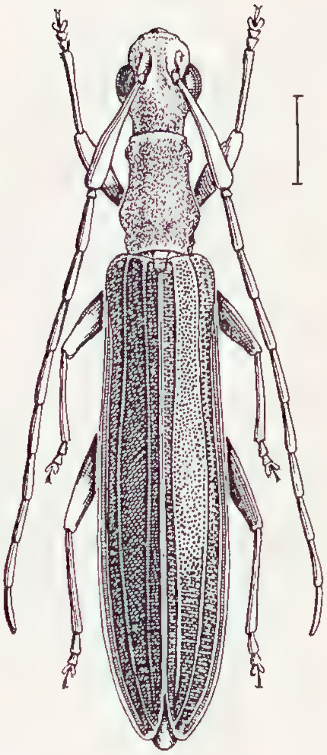

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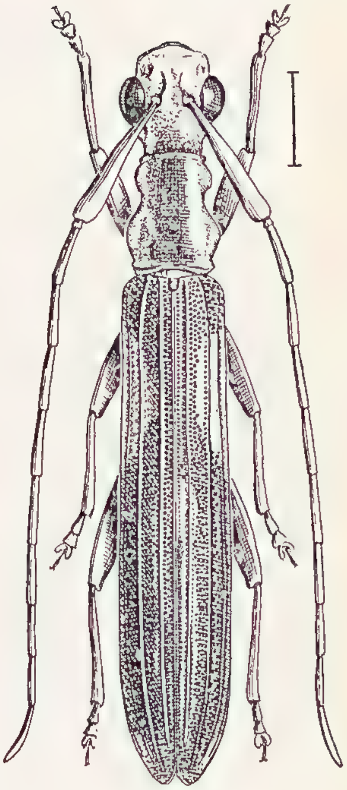

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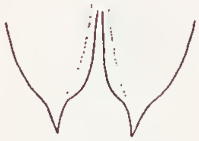

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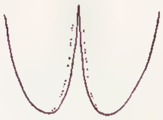

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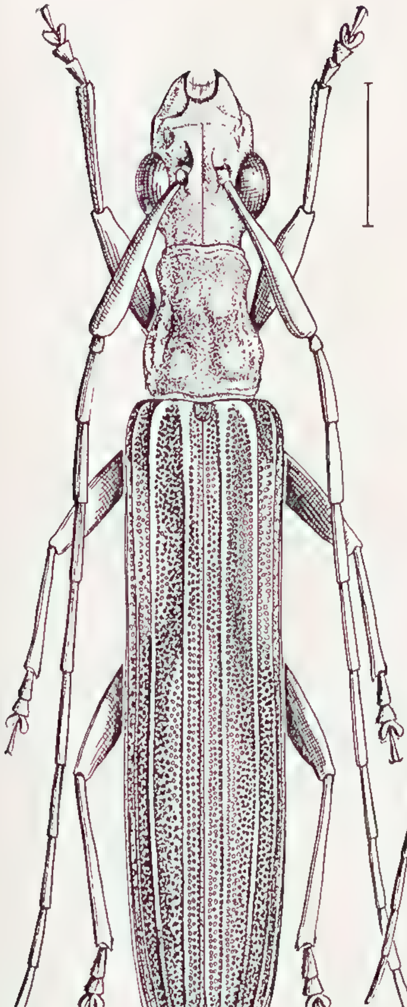

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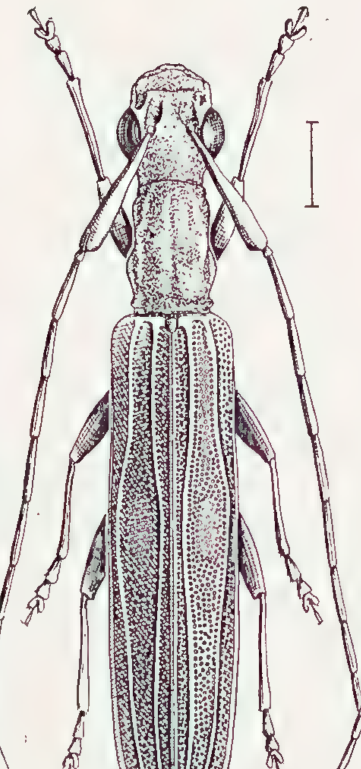

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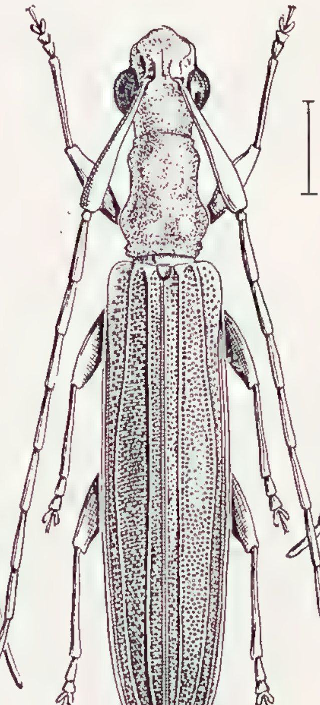

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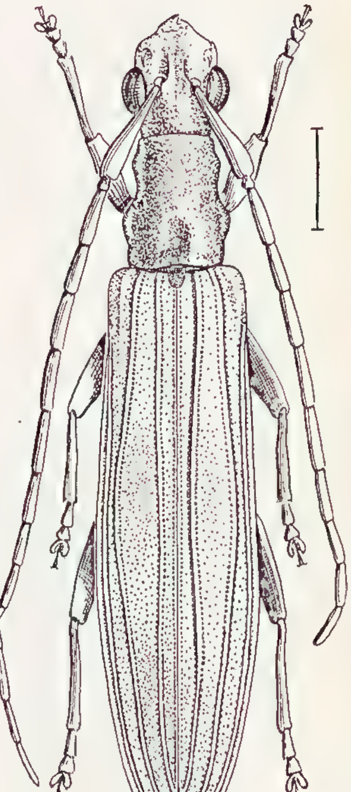

8

NANCY B. ADAMS, *del.*

NATIONAL MUSEUM OF VICTORIA

DESCRIPTIONS OF SOME NEW GUINEA MAMMALS.

By

E. Le G. Troughton, C.M.Z.S.,
Zoologist, Australian Museum.

Since the early days of exploration in New Guinea every opportunity has been taken, within limited resources, to acquire specimens of the remarkably interesting fauna for preservation in the Australian Museum. In 1876, Dr. E. Pierson Ramsay, when Curator, described a marsupial in the first volume of the *Proceedings of the Linnean Society of N. S. Wales*, and several small collections were dealt with prior to the 1885 expedition of the Royal Geographical Society of Australasia to New Guinea.

It is of interest to note that the Society was financed "almost wholly by funds contributed by various colonial Governments", and that some £4,000 was available almost at its inception. Exploration in New Guinea was given special consideration because of the general belief even then in the importance of its natural resources, and also because, though much was known of the coast line, nothing was accurately known of the geology and biology of the interior.

The interest taken by the Museum authorities in the expedition is indicated by the collecting directions supplied by the staff, and the list of "Special Desiderata of the Australian Museum" appearing in the record of arrangements for the exploration. Unfortunately the appointed taxidermist did not accompany the expedition into New Guinea, and the collection of mammals was therefore not very representative. The whole of the collecting and preservation, in addition to his special interest of entomology, fell upon the shoulders of the late W. W. Froggatt, and, as Dr. Ramsay wrote, the greatest praise was due even for the small collections made by him in other branches.

Over the past twenty years continuous efforts have been made to accumulate mammals from New Guinea and the south Pacific region, by enlisting both the aid of the Administration and the services of voluntary collectors, who are supplied with the necessary gear and advice. As a result, much interesting, if somewhat scattered, material has been gratefully acknowledged by the Museum authorities.

It is clearly desirable that such material should be described locally whenever possible, and these preliminary notes upon interesting New Guinea forms have been prepared, with grateful appreciation for the unselfish efforts of various collectors, not only that the results of their work under trying conditions shall not go unnoticed, but also for the assistance of local workers by whom such research unquestionably should be carried out if adequate funds were provided.

Conoyces hageni eitape, subsp. nov.

Diagnosis.—Intermediate in size, coloration, and geographical range between the typical form of Astrolabe Bay and *caurina* of the Mamberamo River district of Dutch New Guinea.

Description.—Back of male much paler than described for *caurina*, but with the dorsal stripe extending to between the ears; the male lighter than female, but both sexes darker than typical form and paler than *caurina*, the male greyish fuscous, and the female fuscous- rather than the seal-brown of the latter. Reversal of hair on back of neck pronounced in male, from a whorl on each shoulder to a single one on the crown; the fur softer and reversal less distinct in young female, and but faint traces of the dorsal line on the nape and occiput. Below, in the male the stronger whitish hairs of the throat are definitely reversed forward from the upper chest to the angle of the jaws. Forearms of male greyish-white, contrasting with back.

Skull relatively smaller and broader than in either allied race, as further indicated by the nasal proportions. Ear relatively larger, that of a young female (43·5 mm.) being almost as long as that of the adult male holotype of *hageni*, and the ear of the young male only 4·5 mm. shorter than that of the adult male holotype of *caurina* with a 33 mm. longer skull.

Dimensions of Holotype.—Young adult male in spirits, with trunk removed: Head and body c. 570; tail 410; pes 141; ear 49·5 × 33 mm.

Skull: Greatest length 111; basal length 97; zygomatic breadth 54; nasals 40·5 × 13·2; p^4 15; molars$^{1-3}$ 19·9 mm.

Habitat.—Eitape district, Territory of New Guinea.

Holotype.—Young adult male No. M.6211 in the Australian Museum collection, with paratype young female M.6098, collected during 1936 by Mr. A. J. Marshall, Honorary Ornithologist.

Note.—As confirmed in Sherborn, *Conoyces* of Lesson, 1842, has priority of *Dorcopsis* Schlegel and Müller, which is quoted in the British Museum Catalogue as 1839–44, but was not published until 1845.

The Status of **Protemnodon** Owen, 1873.

It is notable that the adoption of *Protemnodon* to replace *Wallabia* by Raven[1] was obviously due to misapprehension of essential facts, and it seems unfortunate that Tate and Archbold[2] should have followed him without adequate consideration. Consultation of the original reference clearly shows their discussion of type designation to be unnecessary, as it is there plain that *anak* is the only species available, the other three named being undescribed at the time.

Protemnodon was founded solely upon portion of a left mandibular ramus showing the molar series to belong, as the specific name indicates, to a giant form of kangaroo, and the generic name cannot be made applicable to the group of wallabies. This conclusion was recognized by Owen himself when originally separating *Protemnodon* very widely from *ualabatus*, which he placed in the genus *Halmaturus* when misusing that name for the true wallabies, and by his figures of the teeth given at the time to emphasize the diagnostic differences.

It is obviously unwise to attempt the adoption of names founded upon such fragmentary material for the replacement of well-founded ones applied to living genera. The diagnosis of coloration and external proportions allotted to *Protemnodon* by Raven, and Tate and Archbold, needless to state, refers actually to *Wallabia*, and has nothing whatever to do with the fossil *Protemnodon*.

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[1] Raven.—Encycl. Britt., 14th Ed., xiii, 1929, p. 255.

[2] Tate and Archbold.—Bull. Am. Mus. Nat. Hist., lxxiii, 1937, p. 410.

Rattus gestri Thomas.

Mus gestri Thomas, Ann. Mus. Civ. Genova (2), xviii, 1897, p. 611: Kapa Kapa, between Port Moresby and Hood Point, Central Division of Papua.

Notes.—A recently skinned topotypical adult male, and spiritous female, from Rigo, Central Division of Papua, agree closely with the original description, although the uniformly larger dimensions of the male, coupled with the statement of Thomas that the aged size is a little less than *R. rattus*, suggests that young specimens were chosen for his cotypes. Should examination of the typical series support this explanation of the apparent disparity, the close agreement of the topotypes with the descriptions of both *gestri* and *brachyrhinus* of Tate and Archbold leads to the conclusion that the species are probably synonymous.

It is notable that the Rigo male has the narrow interorbital, zygomatic plate "well thrown forward", and long palatal foramina "reaching one-third the length of m^1", and large bullae of Thomas's description, which are also given as diagnostic of *brachyrhinus*. The cranial measurements of the female cotype of *gestri* and the Rigo male are also within the range given for *brachyrhinus*, while the variable nature of the mammae accounts for any discrepancy between a 10–12 formula.

The pelage and coloration in each description accord with the Rigo topotypes of *gestri*, and the general similarity is confirmed geographically by the southern series of *brachyrhinus* from the Loloki River, 20 miles east of Port Moresby, which only differed slightly from the typical Angabunga (St. Joseph's) River series. Whether examination of the types of *gestri* confirms the identity of *brachyrhinus* with it or not, there is no doubt that *R. vanheurni* of northern Dutch New Guinea is specifically distinct.

A new delta form of *gestri* is apparently represented by a male and female in the Australian Museum from the Aramia River district, and the dimensions of the topotypical adult male of *gestri*, No. M.4968, collected and presented by Mr. A. C. English, are here supplied for comparison with those listed for *brachyrhinus*, as well as with the following subspecies:

Head and body (in spirit) 177; tail 139; pes 30·5; ear 17·5 mm.

Skull: Greatest length 38·5; basal length 35; zygomatic breadth c. 21; interorbital 5·4; nasals 14·7 × 4·8; breadth brain case 15·3; zygomatic plate 4·1; diastema 10·8; palatilar length 18·7; palatal foramina 8·7; bulla length 7·9; upper molar crowns 6·7 mm.

Rattus gestri aramia, subsp. nov.

Diagnosis.—A uniformly smaller race of *gestri*, with a non-projecting zygomatic plate, wider interorbital, relatively heavier molar row, and larger and more inflated bulla in the male.[3]

Description.—Pelage closer and relatively more spinous, darker in mid-dorsal area owing to the finer light tipping and consequent density of darker tips; sides clearer and decidedly warmer, streaked with ochraceous-buff, contrasting with dark back and paler undersurface, which varies from pale pinkish-buff in the female to palest olive-buff in the male. Pes relatively large, and ear small. Mammae 3–3 = 12.

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[3] In view of the diagnostic importance of the bulla, it is unfortunate that Tate and Archbold have not followed the well-founded practice of supplying ear dimensions with which bulla-size is often correlated.

Skull much as in typical *gestri*, but the nasals proportionately shorter and much more broadly wedge-shaped, the interorbital wider, and the zygomatic plate not projecting boldly above as in *gestri*, but comparatively wider owing to the oblique instead of recurved profile. Palatal foramina relatively shorter and narrower, barely reaching the first lamina of m^1 instead of its rear margin. Bulla of male proportionately longer and more inflated.

Dimensions of Types.—Holotype adult male (female in brackets) before skinning: Head and body 157 (136·5); tail 117·5 (98·5); pes 30·5 (27); ear 16 mm.

Skull: Greatest length 38 (33·8); basal length 33·7 (30·2); zygomatic 19·5 (18·1); interorbital 5·5 (5·3); nasals 13·8 × 5·1 (11·7 × 4·5); breadth brain case 15·7 (14·3); zygomatic plate 4·2 (4); diastema 9·9 (8·8); palatilar length c. 17·6 (16·5); palatal foramina 7·6 (7); bulla length 8·1 (6·8); upper molar crowns 7 (6·7); width of m^1 2 mm.

Habitat.—The swampy Aramia Lakes district near the mouth of the Aramia River in the Western Division of Papua; observed living amongst the long swamp grasses about Totani village. Native name "Totoda".

Type Specimens.—Adult male holotype, No. M.4893, and young adult allotype, No. M.4895, in the Australian Museum, collected by the late Allan R. McCulloch, Ichthyologist to the Museum, while accompanying Captain Frank Hurley's expedition in Papua.

Remarks.—Hitherto undescribed because of the general similarity to *gestri*, comparison of the Aramia pair with the recently acquired topotype warrants the description of this delta form to assist in clarifying the relative status of *brachyrhinus*, while providing a small tribute to the initiative of a well-remembered colleague.

Quite apart from the possible merging of *brachyrhinus* with *gestri*, various cranial features distinguish the Aramia form from either species and, with the external characters, doubtless reflect the contrast of its swampy sea-level habitat with "the drier coastal lowlands" habitat given for *brachyrhinus*, and also typical of true *gestri*. The relatively much shorter tail, smaller foot and broader nasalia distinguish this form from *vanheurni*, apart from the obvious geographical separation.

Rattus mordax hageni, subsp. nov.

Diagnosis.—A small highland form, with smaller dimensions and softer and thicker pelage than the typical form from the south-east coast of the Northern Division of Papua, and the subspecies *tramitius* from the Mamberamo River region of Dutch New Guinea; coloration intermediate.

Description.—General colour of back less tawny than in typical form, more buffy-ochraceous, especially in female, the light ticking much finer in accordance with the softer and thicker pelage; evidently warmer than the "blackish-grey, very finely ticked with buffy" of *tramitius*, but paler below. Belly fur much softer than in typical *mordax*, almost lacking spinous hairs, also darker grey basally, with the much paler tips washed with olive-buff instead of the rich clay to ochraceous tone of the allied races. Tail and pes definitely shorter than in the allies, the tail-rings finer than in typical *mordax*, 11–12 against 9–10. Ear relatively large. Mammae 2–2 = 8.

Skull distinguished from the typical form by the less rugged, shorter, but relatively wider build, comparatively short and rounded palatal foramina, which barely attain instead of surpass the alveolar edge, and the definitely smaller bullae and molar row. Published dimensions of the skull of *tramitius* are inadequate, but those given for the adult female holotype suggest that a similar, if less marked, difference in proportions supports the external ones noted.

Dimensions of Types.—Holotype adult male (female in brackets) before skinning: Head and body 170 (157); tail — (129); pes 32·5 (31·5); ear 18 × 14·5 (18 × 13·5) mm.

Skull: Greatest length 40·8 (37); condylo-incisive length 38·2 (35·9); front angle of interparietal to tip of nasals 35·9 (32); zygomatic breadth 20 (19·3); breadth brain case 16·5 (15·1); interorbital 6·1 (5·9); nasals 15·3 × 4·3 (13·5 × 4·1); palatilar length 19·6 (17·8); palatal foramina 7·2 × 2·8 (6·9 × 2·9); bulla length 5·8 (5·9); upper molar crowns 6·7 (6·8); width of m^1 2 (2·1) mm.

Habitat.—Altitude of 5–6,000 ft., in the upper Wahgi River valley on the southern slopes of Mt. Hagen, in the south-east corner of the Sepik Division, Territory of New Guinea. Taken by natives from holes amongst the "pit pit" or cane grass, and said not to enter habitation.

Type Specimens.—Holotype adult male, No. M.6102, allotype adult female, M.6103, in the Australian Museum, collected and presented by Dr. G. A. M. Heydon, of the School of Public Health and Tropical Medicine, Sydney.

Remarks.—It seems evident from the dimensions in the description of the typical *mordax* that the holotype was a young female. The cranial dimensions of an excellent series collected in the Mt. Lamington district by Mr. C. T. McNamara, however, agree very well and confirm the distinction of this small upland and geographically intermediate race.

Rattus browni praecelsus, subsp. nov.

Diagnosis.—A highland form allied to the insular *browni*, but distinguished by the relatively longer tail and larger ear, much thicker and softer, less spinous pelage, narrower more lightly built skull, and short broad palatal foramina. Coloration of back much as in the insular typical race, but lacking the coarse pale grizzling of the spinous hairs. Fore-back, head, and sides of the male washed with ochraceous-tawny, the same areas of the female paler, about cinnamon-buff. Undersurface in both sexes with dark grey basal fur, with buffy-white tips.

Dimensions of Holotype.—Adult male (in spirit): Head and body 122; tail 128; pes 25·5; ear 16 × 12·3 mm.

Skull: Greatest length 31·4; basal length 26·9; zygomatic breadth 14·5; breadth brain case 12·8; interorbital 4·9; nasals 11·7 × 3·2; palatal length 16; palatal foramina 5·5 × 2·2; bulla length 5·6; upper molar crowns 5·1; width m^1 1·5 mm.

Habitat.—The upper Wahgi River valley, about 15 miles south-east of Mt. Hagen, altitude 5–6,000 ft., in the south-east of the Sepik Division, Territory of New Guinea. In grass, swamp, and cane tree country.

Holotype.—Skin and skull of adult male, No. M.6110, in the Australian Museum, collected and presented by Dr. G. A. M. Heydon; also a series collected and presented by Mr. J. L. Taylor, Assistant District Officer in the Morobe District of New Guinea.

Remarks.—The colour and comparative absence of spinous bristles distinguish this species from insular and lowland forms of true *browni*, to which it is allied by the mammary formula and general features of the skull.

Rattus browni aitape, subsp. nov.

Diagnosis.—A relatively large-skulled, long-tailed, short-eared form, with warmly coloured moderately spinous dorsal pelage, contrasting with the pale undersurface, and comparatively large nasalia.

Description.—Pelage short, sparse, and moderately spinous, lacking the close and very coarse bristle-hairs of the typical insular form. General colour of back of a similar but much lighter mixture of brown, the head washed with cinnamon-buff, becoming cinnamon on the shoulders and mid-back, and ochraceous-tawny on the lower back; cheeks palish olive-buffy, and sides of body and rump washed with cinnamon. Under surface basally light mouse-grey, tipped with pale olive-buff, contrasting with upper surface. Tail proportionately very long, and ear short and broad, barely reaching to within 2·5 mm. of the posterior canthus of the eye, when pressed forward.

Skull large and cranium broadly rounded, nasals proportionately long and narrow, the zygomatic plate wide and boldly convex, palatal foramina widely rounded, and mesopterygoid fossa narrowed. Mammae 2–2 = 8.

Dimensions of Holotype.—Adult female (in spirit): Head and body 119; tail 134; pes 25·5; ear 15·5 × 12·5 mm.

Skull: Greatest length 32·6; basal length 27·5; zygomatic breadth 15·8; breadth brain case 13·8; interorbital 4·9; nasals 12·5 × 3·2; palatal length 16·7; palatal foramina 6·1 × 2·3; bulla length 5·7; upper molar crowns 5·1 mm.

Habitat.—Aitape, on the north coast of the Sepik Division of the Mandated Territory of New Guinea.

Holotype.—Skin and skull of adult female, No. M.3721, in the Australian Museum, collected and presented by Mr. R. F. Armstrong while Health Officer in the Aitape District in 1925.

Remarks.—This comparatively well-marked form is distinguished from *lassacquerei* and *manoquarius*, described as races of *R. concolor* from the Manokwari district of northern Dutch New Guinea, by the relative body and tail proportions, shorter ear, and longer but narrower nasalia. The relatively large proportions of the female, differences of pelage and coloration, and much longer nasalia distinguish this coastal race from the high altitude Mt. Hagen form. Cranial dimensions, including those of the nasalia and bullae, coloration, and lack of very coarse bristle-hairs distinguish it from the typical insular *browni*.

Rattus browni suffectus, subsp. nov.

Diagnosis.—A warmly coloured race with pelage of medium coarseness, with a general suffusion of cinnamon-rufous to tawny on the back, and washed with cinnamon below in both sexes. Mammae 2–2 = 8.

Description.—Pelage above harsher than in *praecelsus*, more closely and coarsely bristled, much as in *aitape*, but not nearly as coarse as in the typical insular *browni*. Cinnamon-rufous to tawny wash of back changing to cinnamon on the sides, which contrasts with the greyish olive-buff belly, though the chest and upper belly are washed with cinnamon. Manus and pes buffy-white, but with dark mark pronounced on manus; a dark fuscous line extends along the outside of pes almost to the toes. Ear relatively short and narrow. Tail equalling or slightly exceeding the head and body in males, slightly longer in females; scales fine, 13 to cm. in males, 14 in a female. Skull of medium size, somewhat wider and more robust than in *praecelsus*, and with relatively shorter and broader nasalia and smaller palatal foramina than in *aitape*; much as in *tibicen*, but the palatal foramina much narrower posteriorly, and with smaller and less projecting nasalia.

Dimensions of Holotype.—Adult male (in spirit): Head and body 124·5; tail 124·5; pes 25; ear 14·5 × 11 mm.

Skull: Greatest length 31·9; zygomatic breadth 15·6; breadth brain case 13·6; interorbital 4·7; nasals 11·4 × 3·3; palatal length 16·4; palatal foramina 6·1 × 2·2; upper molar crowns 4·8 (5·1 in one female) mm.

Habitat.—The Mount Lamington district, on the southern border of the Northern Division of Papua.

Type Series.—Skins and skulls of holotype adult male, No. M.4156, allotype, No. 4153, and series of paratypes in the Australian Museum, collected and presented by Mr. C. T. McNamara during 1929, when Government Resident in the Mount Lamington district.

Rattus browni tibicen, subsp. nov.

Diagnosis.—A small-bodied short-tailed form with rather large skull, and relatively small pes and ear. The pelage short, sparse, and softly spinous, not as coarsely bristled as in *suffectus*, more like *praecelsus* from which it differs in density of pelage, colour, shorter tail, with finer scaling, and various cranial dimensions; scales 15 to cm. General tone of back much as in *suffectus* but without the strong cinnamon-rufous suffusion, the general colour above about drabby prout's brown and lacking the pronounced blackish ticking of *praecelsus*; sides of head, limbs and body washed with cinnamon- to olive-buff, blending into the deep olive-buff of the underparts.

Skull proportions much as in the *suffectus* series, but the palatal foramina tapered anteriorly and remarkably widened posteriorly, and the nasalia relatively wider than in any known New Guinea form, about as in Ramsay's type of *echymyoides* from Duke of York Island, with nasals 12 × 3·6 mm.

Dimensions of Holotype.—Adult male, dried skin: Head and body 106; tail 114; pes 23·4; ear 12 mm.

Skull: Greatest length 32; zygomatic breadth c. 16; breadth brain case 13·6; interorbital 5; nasals 11·5 × 3·5; palatal length c. 15·5; palatal foramina 6 × 2·5; upper molar crowns 5 mm.

Habitat.—Fyfe Bay, near Isudau, on the southern coast towards the eastern extremity of Papua.

Holotype.—Adult male skin and skull, No. M.2483, in the Australian Museum, collected some forty years ago by the Rev. H. P. Schlencker, of the London Missionary Society, and presented by the late Thomas Steel, F.L.S.

Melomys muscalis froggatti, subsp. nov.

Diagnosis.—A somewhat larger race, with the undersurface toning instead of contrasting with the sides, larger pes, and smaller ear.

Description.—Pelage short and dense. General coloration of back a buffy-brown grizzled with sayal to prout's brown tipping on the head and mid-back, the cheeks, limbs, and sides washed with cinnamon-buff, which blends with the grey underfur and extends across the mid-belly; throat, chest and inguinal areas pale olive-buff to roots. Pes longer than recorded for typical form, and ear apparently shorter; tail but slightly lighter brown below, with coarser scaling, 13 to cm., the three hairs varying from a little over half to about a scale length.

Skull of similar delicate build and proportions, but somewhat larger, and therefore intermediate between true *muscalis* and *lutillus*, but the interorbital region broadly concave, so that the cranium is more abruptly rounded anteriorly than sloping as in *lutillus*, and the nasalia are broader anteriorly and much more acutely tapered posteriorly. Molar row slightly exceeding the maximum for typical *muscalis*.

Dimensions of Holotype.—Adult male, dried skin: Head and body 115; tail 120; pes 25; ear c. 12 mm.

Skull: Greatest length 29·1; condylo-incisive length 26·5; zygomatic breadth c. 15·7; breadth brain case 13·2; interorbital 4·4; nasals 10·3 × 3·4; palatilar length 12·4; palatal foramina 4·6 × 1·8; upper molar crowns 5·1 mm.

Habitat.—Banks of the Strickland River, about 100 miles above the junction with the Fly River, Western Division of Papua.

Holotype.—Adult male skin and skull, No. M.2377, in the Australian Museum, collected by the late W. W. Froggatt, subsequently Government Entomologist for New South Wales, during the expedition of the Royal Geographical Society of Australasia in 1885.

Remarks.—This form is somewhat intermediate in dimensions and coloration between typical *muscalis* and *lutillus*, thereby probably confirming the original suggestion by Thomas that the small Torresian and Papuan species (with three-haired tail-scales) may represent races of the one variable species. The more inland western Papuan habitat and comparative features, however, appear to warrant subspecific distinction from the nearer ally, and it has been named in honour of its distinguished collector, who had only recently supplied details of the habitat.

Melomys hageni, sp. nov.

Diagnosis.—A bright tan coloured species, apparently allied with *gracilis*, but with shorter tail and ear, rather smaller foot, smaller molar row, brighter coloration above, and with the colour of the sides extending across the belly.

Description.—General tone of back a bright buckthorn-brown, which is clearest on the nape, lightly pencilled with cinnamon-brown, the head a lighter grizzling of warm-buff and grey. Sides of limbs and body clearer ochraceous-buffy, mingling with the grey of the underfur to extend across the middle of the belly; hair of undersurface only entirely white in patches on the throat, upper chest, and inguinal area. Manus whitish, with thin brown mark, pes buffy-brown, with whitish edging. Ear short and broadly rounded. Tail relatively long, but proportionately much shorter than in *gracilis*, in which the type body-measurement was evidently increased by skinning; 14 single-haired scales to the cm. Skull dimensions much as in *gracilis*, but with relatively wider interorbital, and the well-worn molar row smaller.

Dimensions of the Holotype.—Adult male (in spirit): Head and body 124; tail 154; pes 26·5; ear 14 × 11·5 mm.

Skull: Greatest length 33; condylo-incisive length 29·2; zygomatic breadth c. 16·1; interorbital 5·6; nasals 10·9 × 3·1; palatilar length 14·8; palatal foramina 4·2 × 1·9; upper molar crowns 5·9; width of m^1 1·9 mm.

Habitat.—Taken from "grass nest well up in 'pit pit' or cane grass" in the upper Wahgi River valley, altitude 5–6,000 ft., near Mt. Hagen, in the south-east corner of the Sepik Division, Territory of New Guinea.

Holotype.—Adult male skin and skull with well-worn teeth, No. M.6113, in the Australian Museum, collected and presented by Dr. G. A. M. Heydon during 1936.

Remarks.—The remarkably bright coloration, noted by the collector, darker belly, and the shorter tail and ear, and the cranial features which would doubtless be emphasized in comparison of series in view of the geographical separation, distinguish this species from *gracilis* of the Angabunga River region of the Central Division of Papua.

Uromys papuanus Ramsay.

Hapalotis papuanus Ramsay, Proc. Linn. Soc. N.S.W., viii, 1883, p. 18, pl. 11.
Uromys ductor Thomas, Ann. Mag. Nat. Hist. (8), xii, 1913, p. 213.
Uromys prolixus Thomas, Ann. Mag. Nat. Hist. (8), xii, 1913, p. 213.

Review of Characters.—In discounting the validity of *papuanus*, while describing *ductor* and *prolixus* from the same faunal area, Oldfield Thomas referred to the disappearance of the type, uncertainty of locality, and inconsistency of some dimensions. Some years ago an unsuccessful search was made for the type in both the Australian and Macleay Museum collections, and again this year during the visit of Mr. G. H. H. Tate, Mammalogist of the American Museum of Natural History. There is no reason, however, to doubt the locality given in Ramsay's introduction as "collected at the foot of, and on the slopes of, Mount Astrolabe Range . . . . inland from Port Moresby", which definitely embraces the habitat of *prolixus*, from Haveri in the mountains near the Astrolabe Range.

Regarding the diagnostic dimensions of *papuanus*, it is notable that the upper molar measurement of 0·49 in. = 12·5 mm., allowing for alveolar length, agrees with the 12·2 mm. given for *prolixus*. The external head length of 2·7 in. = 68·5 mm. also accords with the total cranial length of 66·6 mm. given for *prolixus*, the excessive condylo-incisive length in Ramsay's description therefore doubtless being due to a printer's error.

Concerning the status of *ductor*, which is allied geographically with *papuanus* rather than *validus*, it is notable that inconsistencies occur in descriptions by Thomas similar to those upon which he discounted Ramsay's species. The pes length of *prolixus* is given as 64 mm. in the description, and 61 mm. in the dimensions list, which is more likely to be correct, thus reducing the disparity in size with *ductor*. Likewise, the skull of *prolixus* was described as much longer than in *ductor* and more slender because of the similar zygomatic width, but one finds that the difference in greatest cranial length between the holotypes is merely 1·6 mm., as listed by Thomas.

It is notable that the external dimensions of *ductor* were from a dried skin, accounting for the greater head and body length and shorter pes in comparison with the spiritous dimensions of *prolixus*. Therefore, as Thomas remarked that little dependence could be placed upon the coloration of the holotype *prolixus*, there remains apparently only the slightly shorter molar row of *ductor*, given as 11·2 mm., to distinguish it from *papuanus*, with which *prolixus* is synonymous.

Additional Note.—Since writing the above, a copy of Tate's important review of "Some Muridae of the Indo-Australian Region" became available, in which it is noted that *Hapalotis papuanus*[1] fits only the genus *Uromys*, and must therefore be assigned to the *validus* group. The measurements and notes provided by Tate indicate considerable variation and intergradation in material fairly topotypical of *validus* and *ductor*, in view of which *ductor* is regarded by him as a subspecies of *validus*, embracing *papuanus* as well as *prolixus*. In view of the acceptance of *papuanus* as an *Uromys*, however, and the intermediate range of *ductor*, Ramsay's species must be considered before either of the later described ones of the same group, irrespective of full or subspecific status.

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[1] Tate.—Bull. Amer. Mus. Nat. Hist., lxxii, art. 6, 1936, p. 600.

Regarding the status of *U. barbatus*, the comparatively high habitat given as from 3–7,000 ft. in the upper Aroa Basin, coupled with cranial features given by Thomas (*loc. cit.*, p. 212) on examining the holotype, suggests that it is representative of a definite and comparatively short-tailed mountain form, rather than the probable equal of *ductor*, as suggested by Tate.

In contrast with the extremely variable representation of the genus from the southern coast of Papua, the following well marked species is now described from the Mount Lamington district of the Northern Division.

Uromys lamington, sp. nov.

Diagnosis.—A proportionately small-bodied, long-tailed species, with correspondingly short but broad skull, which has decidedly smaller nasalia and palatal foramina than any of the known Papuan allies.

Description.—General tone of short pile of back tawny-olive, grizzled with some shining ochraceous and buffy tips, and the blackish-brown longer hairs which are closest on the mid-back but not dense enough to form a dark line; shoulders tinged with smoky grey and head lighter than back, owing to lack of dark hairs and shining ochraceous-buff tipping. Cheeks and sides of body paler, grizzled greyish avellaneous to wood-brown. Basal fur of back dark mouse grey. Short sparse fur of entire undersurface whitish ivory yellow to the skin. Manus and pes buffy-white, a pale mummy-brown mark extending down front of forearm onto the manus; a brownish tinge on outside of pes. Entirely yellowish part of tail slightly less than half its length, but underneath the mottling of yellow extends to within 2 in. of the root.

Skull of adult male delicately built, relatively short and with wide arches, but narrow rostrum, the nasals and palatal foramina smaller than in allied species. Bullae short but well rounded. Molar row short and broad.

Dimensions of Holotype.—In spirit: Head and body 250; tail 270; pes 58·5; ear 25·5 mm.

Skull: Greatest length 62; condylo-incisive length 53·1; zygomatic breadth 31·5; nasals 22·6 × 6·6; interorbital 10; breadth brain case 20; palatilar length 29·8; palatal foramina 6·4 × 3·2; mesopterygoid fossa 5; bulla length 5·5; upper molar crowns 11·2; width m^1 3·2 mm.

Habitat.—Mount Lamington district, on the southern border of the Northern Division of Papua.

Holotype.—Skin and skull of adult male, No. M.4684, in the Australian Museum, collected and presented by Mr. C. T. McNamara during 1929, when Government Resident in the Mount Lamington district.

Remarks.—The coloration of this proportionately long-tailed, short-skulled species is intermediate between the rusty-blackish backed and the paler cinnamon-buff to brownish allied forms. It is readily distinguished from nearer geographical allies by the small nasals, associated with the relatively very small rostrum and palatal foramina, and from *U. scaphax* of western Dutch New Guinea by its longer, more equally bicoloured tail, and larger pes and molar row.

Hydromys oriens, sp. nov.

Diagnosis.—A robust fulvous species, with bright coloration and dimensions distinguishing it from the other New Guinea species (*esox*) and allying it with the longer-tailed north Australian forms.

Description.—General tone of back prout's brown (Ridgway), grizzled with ochraceous-tawny and mummy-brown tips; face and crown darker, mummy-brown speckled with ochraceous-buff. Fur of undersurface unusually pale to the base, softer than pale smoke grey, the tips unevenly washed with bright ochraceous-tawny. Manus and pes paler than in Australian forms, about light-buff, the extension of the dark forearm-mark restricted to a narrow bar not covering the manus, and in the holotype ceasing at the wrist on one side and continuing to the outer digits on the other. A little less than half the short-haired part of tail black, instead of one-third in *H. beccarii* of Kei Islands, and three-fifths in the typical *H. esox*.

Distinguished cranially from *esox* by the relatively greater zygomatic width, and larger nasalia and dentition, and from the insular *H. moae* by the generally more robust, much wider skull, shorter, broader, more truncated nasalia, and larger bullae.

Dimensions of Holotype.—Adult male (in spirits): Head and body 276; tail 257; pes 60; ear 18·5 × 15·5 mm.

Skull: Greatest length 53·8; basal length 49·4; zygomatic breadth 28; nasals 17·2 × 5·9; interorbital 6·5; brain case width 20·2; palatilar length 25·4; palatal foramina 5 × 2·9; upper molar row 8·7; breadth m^1 3·1; bulla length 7·3 mm.

Habitat.—Mount Lamington district, on the southern border of the Northern Division of Papua.

Holotype.—Skin and skull of an adult male, No. M.4683, in the Australian Museum, collected and presented by Mr. C. T. McNamara during 1929, when Government Resident in the Mount Lamington district.

Remarks.—Distinguished from *esox* of the south and north-west coast, and the insular *moae*, by its much longer tail, and cranial proportions. General dimensions nearest *H. longmani* of the Atherton Tableland, north Queensland, but with relatively longer pes, smaller palatal foramina, wider nasals, and heavier molar row.

REDISCOVERY OF *VOLUTA BRAZIERI* COX.

By

TOM IREDALE,
Conchologist, The Australian Museum.

MORE than sixty years ago Cox[1] described *Voluta* (*Callipara*) *brazieri* from Wooli Wooli, Clarence River, New South Wales, giving a coloured figure of the back view about two inches in length. The measurements of the shell read: length 1·10 inch, breadth 0·55 inch, i.e., 28 mm. by 14 mm.

Thirty years later the unique type passed into the collection of the British Museum, and Smith[2] wrote a note pointing out the inadequacy of the illustration and redescribed it, giving another figure from in front, also about two inches long. Smith, however, concluded that it had been referred to *Callipara* from a vague resemblance only, and that it had more the characteristics of *Lyria*, and then suggested that it was merely a monstrous growth of *Voluta deliciosa* Montrouzier[3] from New Caledonia. Acting upon Smith's advice, Hedley[4] admitted *Lyria deliciosa* in his Check-List, synonymizing *V. brazieri*. However, Hedley also allowed *Lyria nucleus* Lamarck, the type of *Lyria*, under the name *L. pattersonia* Perry in that list. The latter is the type of *Lyria*, and *deliciosa* is merely the new Caledonian relative, *pattersonia* being a common Norfolk Island shell. It was apparent that both could not, under normal circumstances, occur in this State, and study of Cox's figure with Smith's illustration appeared to negative Smith's conclusion.

Mr. C. Laseron, who has been responsible for most of the recent additions to our local faunula, travelled to Forster, near Cape Hawke, and there secured many species from Point Halliday not common around Sydney. He enlisted the cooperation of a local naturalist, Mr. Muddle, who sent him more shells, and then recently brought some more down to Sydney. Among these, Mr. Laseron detected a strange little Volutid, which I immediately recognized as the missing *Voluta brazieri* Cox. It proved, certainly, that the original shell was normal, that it was not *Lyria montrouzieri*, and was not even congeneric. It was then found that Cox had been anticipated in his specific choice by Brazier,[5] so that a new name is necessary. In view of the confusion surrounding the original shell now in the British Museum, I am not renaming that specimen, but am describing the shell before me as a new genus and species.

Genus **Lyreneta**, nov.

Type **L. laseroni**, nov.

Shell small, sub-coniform, spire very short, mouth elongate, almost equalling length of shell, outer lip sinuously curved, thin, anterior canal broadly open, columella sinuous, swollen posteriorly, medially sinuate, anteriorly triplicate, the median fold largest, the posterior smallest. Coloration of dead shell, bluish, banded with three broad dull brown bands, anterior and median ones indistinct, one around the shoulder dark and well marked, but interrupted by half a dozen yellow blotches. Underneath the colouring there is a series of concentric dark interrupted lines. Protoconch of two whorls, apparently smooth, succeeded by five adult whorls, the last two smooth, the others longitudinally plicate, about twelve plications being counted on the antepenultimate whorl.

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[1] Cox.—*Proc. Zool. Soc.* (Lond.), 1873, p. 568, pl. xlviii, fig. 8, Nov.
[2] Smith.—*Proc. Mal. Soc.* (Lond.), vi, pl. 178, text-fig., Sept., 1904.
[3] Montrouzier.—*Journ. de Conch.*, vii, p. 375, June, 1859; *id.*, viii, p. 121, pl. 2, figs. 7, 8, Jan., 1860.
[4] Hedley.—*Journ. Proc. Roy. Soc. N.S.W.*, li, p. 74, June, 19, 1918.
[5] Brazier.—*Proc. Zool. Soc.* (Lond.), 1869, p. 561, June, 1870.

Length, 18 mm.; of aperture, 15 mm.; breadth 9 mm.

Cox wrote: "Indistinctly banded about the centre with dark chestnut." Smith described it: "Light brown colour, mottled irregularly with white, exhibiting upon the body whorl three bands of a darker brown, two being near the middle and one just below the shoulder."

On account of the thin lip, Smith wrote, "evidently not adult", and this may be correct, but while in *Lyria* the outer lip is thickened, the thin young lip is straight. Reference to the forms of *Lyria* show that in the typical group the spire is lengthened, the mouth is broader anteriorly, the columella is less curved and the teeth less pronounced. The Norfolk Island shell is the type of *pattersonia* (= *nucleus*), and the Kermadec Island specimens are very similar. The Lord Howe Island shells are nearer the New Caledonian *deliciosa*, being a little narrower with a longer spire but similar coloration, and may be called *Lyria deliciosa howensis*, subsp. nov. The specimen from Mast Head Reef, recorded by Hedley as *deliciosa*, is similar in colouring, but is much larger, with a very long spire, and may be named *Lyria opposita*, sp. nov., measuring 36 mm. in length, with a spire 14 mm. long.; breadth 17 mm. A rather squat specimen of *L. deliciosa* from New Caledonia measures 28 mm. long, spire 9 mm.; breadth 18 mm. In these the plications disappear on the body whorl, but in specimens from New South Wales, recorded as *pattersonia* = *nucleus*, the body whorl is strongly plicate, similar to that of the typical species, and there is not yet sufficient material to separate them, but they are quite unlike the species *Lyreneta laseroni* here described.

Since the above was written Mr. Laseron has again visited Point Halliday, and was successful in securing a much larger specimen and three smaller and broken ones, including one showing a perfect apex. The protoconch is of one and a half whorls, smooth, succeeded by the adult sculpture without any intervening varix. The early whorls are ribbed, the ribs few, low and distant. The coloration of the protoconch is pink, the succeeding whorls showing a couple of concentric colour lines of brown, on the third adult whorl the shoulder becoming clouded with brown.

The large shell measures 27 mm. in length, the apical whorls missing, with a breadth of 17 mm., the coloration being more brown than in the smaller shell.

Miss Annie Trotter, of Point Halliday, has written to Mr. Laseron that still another perfect specimen and several broken ones have been found.

AN UNRECORDED METEORITE FROM COOLAC, NEW SOUTH WALES.

By

T. HODGE-SMITH,

Mineralogist, The Australian Museum.

(Plate xx, and Figure 1.)

THROUGH the kindness of Mr. W. E. Williams I was informed that Mr. Noel McMahon, of Coolac, New South Wales possessed an object thought to be a meteorite. On request, Mr. McMahon very generously sent the specimen to the Museum on loan, with permission to cut off a small portion for purposes of investigation.

He stated that his grandfather, Thomas McMahon, found the iron about the year 1874 on his selection known as Happy Valley, about three miles west of Coolac, Parish Bongongolong, County Harden, New South Wales, latitude 34° 58′ S., longitude 148° 7′ 30″ W.

Mr. McMahon believes that his grandfather found it four feet below the surface while prospecting for gold. He further reports that "there is a distinct depression in the ground where I believe the meteorite was found. This would be about twenty yards wide; a dry creek in summer now passes through the depression."

The iron was used by his grandmother as a firestop in an open fireplace for about four or five years, when it was sent to Sydney for analysis. According to Mr. McMahon, the result of the analysis was "that it had been in a fire on this earth". I am unable to discover who reported on the matter or to whom the sample was submitted.

The appearance of the meteorite when received at the Museum was that of a typical iron with broad somewhat shallow "thumb-marks", and roughly pyramidal in shape, measuring 225 mm. by 195 mm. by 180 mm. It weighed 42 lb. 8 oz. (19·28 kg.), and the specific gravity, taken on a portion weighing half a kilogram, is 7·15.

An attempt to cut the iron with an ordinary hacksaw failed, and Luke Muras, Limited, very kindly undertook to cut it. They found considerable difficulty owing to the presence of inclusions, some of which were silicate minerals. Finally, a little more than half a kilogram was cut off.

On polishing a small surface of the meteorite, when first received, no trace of Widmanstätten figures was observed. Later, a surface measuring 75 mm. by 40 mm. (Plate xx, fig. 2) showed only traces of the octahedral structure. Apparently the four or five years that the iron served as a firestop had been sufficient partially to destroy this structure. In the top section of the etched surface remnants of the taenite bands exist to show the octahedral orientation; a small portion of this area has been enlarged somewhat and is shown in

Fig. 1. It will be seen that the granular structure already produced in the kamacite bands has begun to invade the taenite bands. Elsewhere the etched surface shows that the kamacite and taenite bands have been converted completely to a granular mass. The grains are mostly allotriomorphic, more or less of an even size, averaging about three millimetres in diameter. On the left side of the etched surface can be seen numerous inclusions which are made up of graphite, iron carbides, and silicate minerals. These three are generally associated with each other, although the silicates are sometimes found alone surrounded by nickel iron. The silicate grains are very small and can be seen with the unaided eye only after careful search.

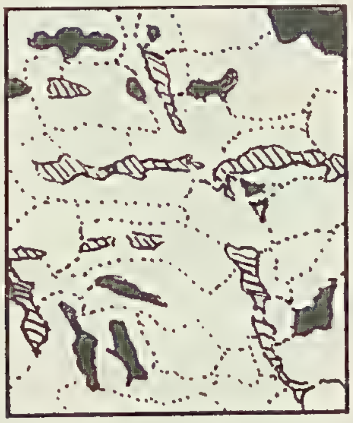


Fig. 1.—Small portion of the etched surface showing the breaking up of the taenite bands by granulation, which has already affected the kamacite bands. The hatched portion is taenite, the black portions are inclusions, and the dotted lines indicate the boundaries of the grains.

According to Berwerth's classification, the iron is an artificial kamacite metabolite (KMe). From the analysis the nickel-iron ratio is over sixteen, and therefore it is likely that it belonged to the broadest octahedrites.

On dissolving forty grammes of drillings in hydrochloric acid the strong smell of hydrocarbons was observed, indicating the presence of carbides. When the meteorite was first received a few filings were dissolved in hydrochloric acid and the characteristic unpleasant odour of hydrocarbons was not noticed. However, two other portions, one a solid piece, gave off this characteristic odour.

The evolution of these hydrocarbons on treatment with acid is of particular interest in New South Wales. During the Great War (1914–1918) large importations of calcium carbide were made from a hitherto untried source. Many of the barrels which contained the calcium carbide also contained carbide of iron, sometimes in lumps weighing several kilograms. Many of these lumps have been picked up and submitted as meteorites. The characteristic smell given off on treatment with acid has been one of the tests confirming their artificial origin.

The residue from the acid solution consisted of carbon, silicate minerals, and bright steel-grey metallic flakes, which were strongly magnetic. The metallic flakes were subsequently dissolved completely in nitric acid, forming a brown solution. They consist of cohenite, with the composition $(Fe_2Ni)_3C$.

The insoluble consists of:

	Grammes.	Weight per cent.
Cohenite	0·3229	0·79
Free carbon	0·0036	0·01
Silicates (by difference)	0·1353	0·33
Total	0·4618	1·13

The total carbon determined on a separate portion weighing 0·9982 grammes was found to be 0·68 per cent. Thus the total combined carbon is 0·67 per cent.

The amount of insoluble appears to vary considerably. In a portion weighing 100 grammes the total insoluble weighed 0·6480 gramme. This would indicate that the carbides, free carbon, and the silicates are irregularly distributed throughout the mass. This is further borne out by their distribution in the polished section.

The combined carbon required for the cohenite is 0·05 per cent., so that other carbides present contain 0·62 per cent. of carbon. The nature of these carbides was not determined.

The silicate mineral consisted of irregular grains, the largest of which was slightly over one millimetre in diameter. The colour of the larger pieces is greyish-white, while the very small grains are colourless. Microscopic examination proved the mineral to be enstatite.

Chemical analysis gave the following result:

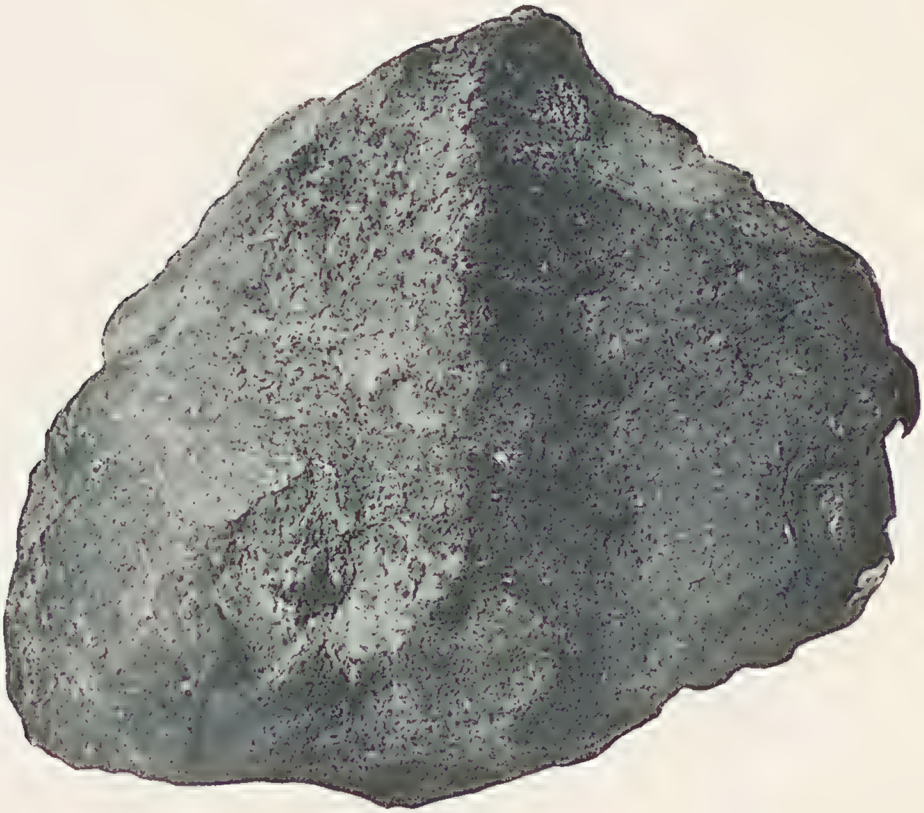
Fe	92·79
Ni	4·72
Co	0·26
S	1·27
P	0·06
C (free)	0·01
C (combined)	0·67
Silicates	0·33
	100·11

Deducting 2·24 per cent. from the total iron required for the monosulphide, the value of n is 19·1. Assuming that the whole of the combined carbon is present as iron carbide, the value of n would be 16·4.

EXPLANATION OF PLATE XX.

Fig. 1.—The Coolac meteorite.

Fig. 2.—An etched surface of the Coolac meteorite. The dark bands on the light upper portion of the area are composed of taenite and cohenite, and clearly indicate the octahedral nature of the iron. The dark parts on the left and lower portions of the area are inclusions of graphite, iron carbides, and silicate minerals.



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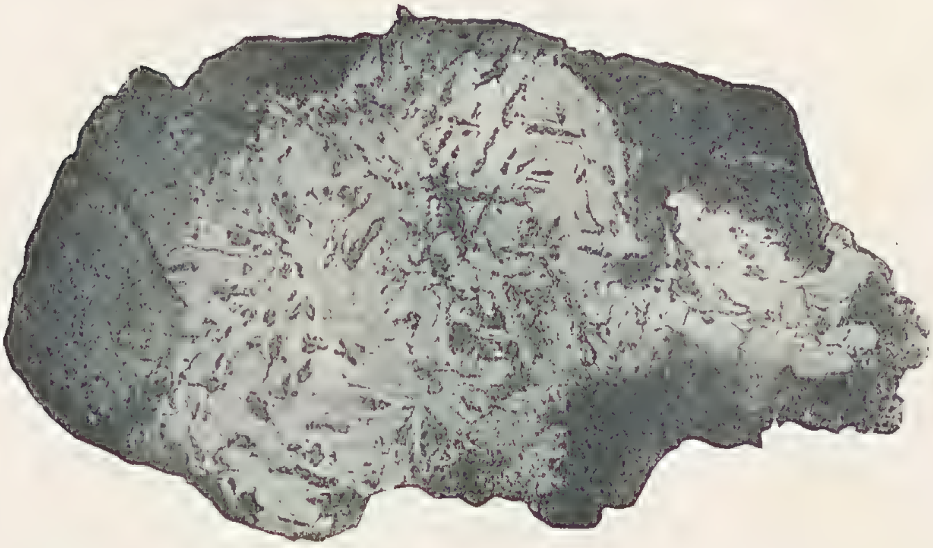

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G. C. CLUTTON, photo.

NATIONAL MUSEUM OF VICTORIA

UEBER EINIGE NEUE DIPLOPODEN AUS AUSTRALIEN.*

VON
DR. K. W. VERHOEFF,
Pasing bei München.

(Mit 18 Abbildungen.)

MIT Diplopoden aus Australien beschäftige ich mich in diesem Aufsatz zum 3. Male, was mich zugleich veranlasst, meine beiden früheren Publikationen hier namhaft zu machen, nämlich einmal die austral. Diplop. Dr. Mjöberg's in *Arkiv für Zoologi*, Bd. 16, N. 5, Stockholm, 1924, S. 1–142, und dann Diplopoda in the Australian Museum, RECORDS OF THE AUSTRALIAN MUSEUM, Vol. 16, N. 2, 1928, S. 79–115.

Die im folgenden bearbeiteten neuen Formen verdanke ich Herrn Dr. E. C. Chisholm in Comboyne, N. S. Wales, welcher dieselben im dortigen nördlichen Küstengebiet sammelte. Ihm sind zwei der neuen Arten gewidmet worden.

Es werden im folgenden besprochen 4 Strongylosomiden—*Gigantowales* n.g., *Walestessara* n. subg., *Parwalesoma* n.g., *Myallosoma* eine n. sp.—und ein Vertreter der Spiroboloidea: *Ainigmabolus* n.g.

Der Umstand, dass alle mir aus der Gegend von Comboyne geschickten Arten neu sind, zeigt in Einklang mit sonstigen Erfahrungen, dass einerseits in Australien noch sehr viele Diplopoden zu entdecken sind und andererseits die Areale der Arten keine grosse Ausdehnung haben, wenn es auch vorläufig noch unmöglich ist, den Fragen lokaler Verbreitung näher zu treten.

Strongylosomidae.

In Australien bilden die Strongylosomiden die wichtigste Diplopoden-Familie. Da ich in meinem Aufsatze über Sven Hedins chinesische Myriapoden-Ausbeute, *Arkiv für Zoologi*, B. 26, N. 10, 1933, S. 1–41, die Strongylosomiden in die beiden Unterfamilien der Strongylosominae (mit freiem Solänomerit und völlig ohne Solänophor), sowie Orthomorphinae (stets mit einem das Solänomerit scheidenartig umgebenden Solänophor) geteilt habe, so sei vorausbemerkt, dass die im folgenden besprochenen australischen Gattungen alle zu der primitiveren Gruppe, also den Strongylosominae gehören, und dass bei ihnen die Gonopoden durch grosses, keuliges Solänomerit ausgezeichnet sind, das also deswegen auch keinerlei Umscheidung aufweist.

Für die australischen Strongylosomiden habe ich 1928 a.a.O. zwei Schlüssel aufgestellt, und zwar den einen nach dem Bau der Rumpfringe und den anderen nach den Gonopoden. Entsprechende Schlüssel findet man auch in meinem

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* 141. Diplopoden—Aufsatz.

Diplopoden-Werk "Bronn's Klassen und Ordnungen des Tierreichs", 10. Lief. Leipzig, 1930, S. 1593. Im folgenden beziehe ich mich zur Feststellung der verwandtschaftlichen Position der neuen Gruppen in erster Linie auf meine genannten Schlüssel. Zugleich möge aber auch hier darauf hingewiesen werden, dass es nicht wenige Formenbeschreibungen gibt, welche heute für uns ganz bedeutungslos sind, und zwar teils deshalb, weil sie die Gonopoden, also die wichtigsten Organe, überhaupt nicht berücksichtigen, teils weil ihnen, selbst wenn letzteres der Fall ist, keine Abbildungen beigegeben werden, sodass es unmöglich ist, sich von den Gonopoden eine ausreichende Vorstellung zu machen. Diese Organe sind oft so verwickelt gebaut, dass es mir erst nach einem umständlichen vergleichend-morphologischen Studium möglich geworden ist, einen "Ariadne-Faden" zu finden. Näher habe ich mich darüber bereits in dem genannten Aufsatz über Sven Hedins Myriapoden ausgesprochen.

Gigantowales, n.g.

Nach dem Schlüssel für die Rumpfringe steht *Gigantowales* neben *Walesoma*, also ist das Sternit am 6. Beinpaar des ♂ ohne Auszeichnung und die Hüften am 6. und 7. Beinpaar des ♂ bleiben einfach.

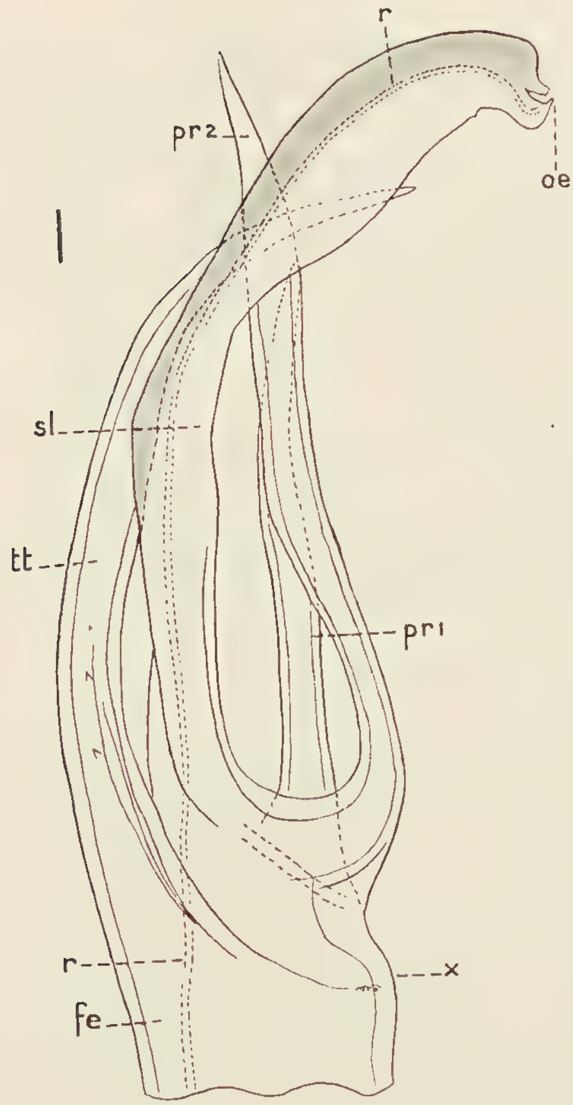
Der Gonopoden-Schlüssel führt auf *Aulacoporus*, aber diese Gattung besitzt sehr abweichende Gonopoden, indem der Tibiotarsus fehlt oder rudimentär ist, während er bei *Gigantowales* (Abb. 1) als ein langer, säbelartiger Fortsatz entwickelt. Das Solänomerit erreicht bei *Aulacoporus* höchstens 2/3 der Femurlänge und ist am Grunde am stärksten, das Femur schlank, ohne Rippe, am Ende quer scharf abgegrenzt. Bei *Gigantowales* dagegen übertrifft das Solänomerit nicht nur die Länge des Femur (Abb. 1 und 2), sondern es ist auch zugleich in der Endhälfte keulig verdickt, während das ebenfalls recht keulig gegen das Ende verbreiterte Femur eine kräftige Schrägrippe (k, Abb. 2) besitzt, und auch am Ende abgeschrägt, ohne scharfe Quergrenze. Bei *Aulacoporus* teilen sich die Gonopoden am Femurende in zwei Aeste, nämlich Solänomerit und einen schmalen Fortsatz, bei *Gigantowales* dagegen spaltet sich der Gonopod hinter dem Femur in vier kräftige Aeste (Abb. 1), den säbelartigen Tibiotarsus (tt), zwei dolchartige postfemorale Fortsätze (pr1, pr2) und das mächtige Solänomerit, welches alle drei andern überragt.

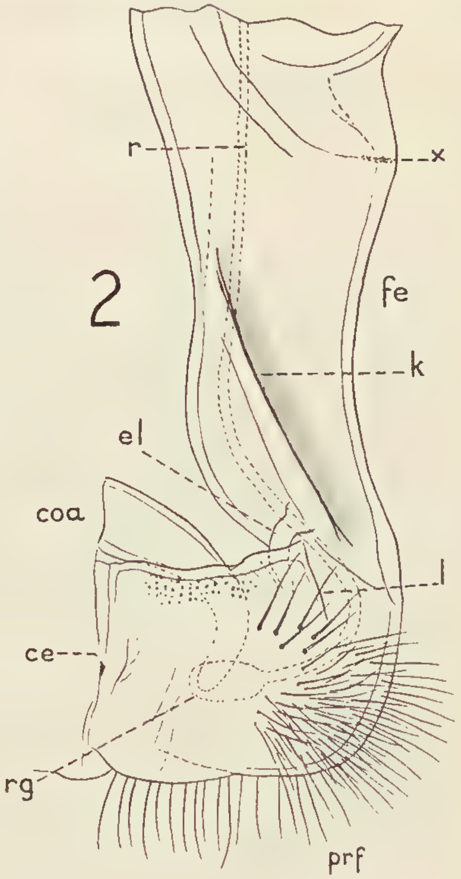
Durch diese Vierästigkeit erinnern aber die Gonopoden überhaupt viel mehr an diejenigen von *Leucotessara* und *Hoplatessara* (RECORDS OF THE AUSTRALIAN MUSEUM, Vol. xvi, No. 2, 1928, Taf. ix und xi), aber beide Gattungen gemeinsam unterscheiden sich sowohl durch den viel grösseren und zugleich stark keuligen Tibiotarsus, als auch durch das sehr kurze Femur, ohne Rippe. Im übrigen sind aber beide Gattungen vor *Gigantowales* noch durch andere Merkmale ausgezeichnet, nämlich *Hoplatessara* durch Hintereckenzipfel der Seitenwülste der Rumpfringe, und *Leucotessara* durch Erweiterung der Hüften am 6. und 7. Beinpaar des ♂.

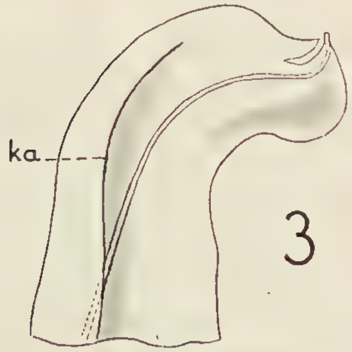
Gigantowales chisholmi, n. sp.

Mit 70 mm. Länge und 7½ mm. Breite stellt diese Form den grössten mir bekannten Vertreter der Strongylosomiden vor, was bei der grossen Zahl der bekannten Arten schon etwas heissen will.

Rücken dunkelbraun mit 3–4 mm. br. gelblichweissem Rückenband, welches vom Kopf bis zur Telsonspitze reicht. Rücken ziemlichmatt, unregelmässig gerunzelt, Ringe mit Seitenwülsten, neben denen des 2. Ringes eine innere, tiefe







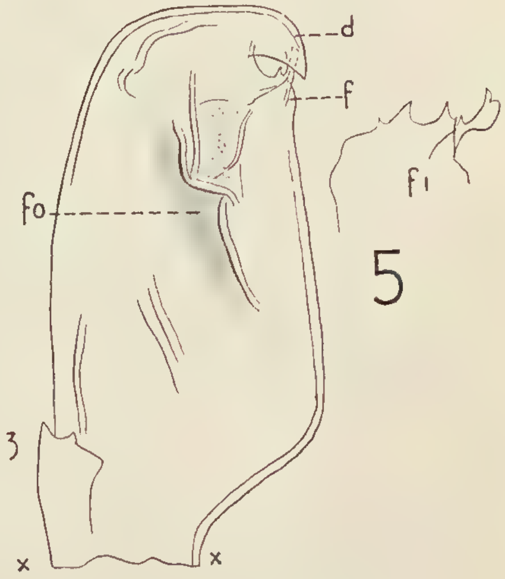


Abb. 1-3.—*Gigantowales* n.g. *chisholmi*, n. sp.

1. Endhälfte eines Gonopod von aussen gesehen: × 56. fe, Femurabschnitt; sl, Solänomerit; tt, Tibiotarsus; r, Spermagang; oe, Mündung desselben; pr1, pr2, Fortsätze am Femurende.
2. Grundhälfte dieses Gonopod, ohne das Coxit, von aussen gesehen: × 56. prf, Präfemur; coa, Coxalhorn; rg, Basalgrube des Spermaganges; fe, Femurabschnitt; el, Verbindung mit dem Präfemur; k, Längsleiste. Die Stelle x entspricht x der Abb. 1.
3. Ende des Solänomerit mit der Mündung des Spermaganges.

Abb. 5.—*Hoplatessara cruciata*, n. sp.

5. Der bei x, x abgebrochene und von innen gesehene Tibiotarsus. fo, eine Grube; d, Endzahn; f, Fortsatz vor demselben: × 56. Rechts daneben (f1) der Präterminale Fortsatz: × 125.

Längsrinne, dieser Wulst hinten vorragend, aber abgerundet. Wülste am 3. Ring hinten in kleine Ecke vorragend. Die schmalen Wülste an den übrigen Ringen ragen hinten nicht vor, nur am 13.–17. zeigt sich hinten ein schwacher Vorsprung.

Nähte mit nur schwacher Kerbung, Querfurchen der Metatergite gut ausgeprägt, aber weit von den Seitenfurchen entfernt bleibend, diese ein beträchtliches Stück hinter den Nähten aufhörend. Poren der Wehrdrüsen hinten in den Wülsten gelegen, und zwar im vorderen Teil von ovalen Längsgruben. Endfortsatz des Telson gerade nach hinten gerichtet, Analklappen vor dem Innenrand gefurcht, Subanalplatte abgerundet.

Vorderkopf mit zerstreuten Grübchen, beim ♂ ohne Auszeichnung, Backen unten stark quer gerunzelt, Kinn mit Mediankiel.

1. Beinpaar des ♂ am Femur unten mit kurzem, beborstetem Zapfen, der nicht länger als breit ist und wenig vorragt, Innenrand fast gerade, Aussenrand stark gebogen, Tarsus mit dichter Bürste.

2. Beinpaar des ♂ mit von einander entfernten Hüften, die am Ende schwach gebuckelt. Innen von diesen Buckeln münden die *Vasa deferentia* in kleinem Porus, der im Bogen innen von häutigem Wülst umgeben. Im Endteil des Sternit eine kreuzförmige Verdickung mit kurzen Seitenarmen und dickem Endknopf. Aussen vom Porus der Samenwege auf dem Buckel eine Gruppe von 7–8 starken Borsten.

Zwischen den Hüften des 3. Beinpaares springt am Sternit beim ♂ eine hohe und breite Platte vor mit stumpfwinkeligem Endrand, viel höher als die benachbarten Hüften.

Zwischen den ganz getrennten Gelenkgruben der Gonopoden ein stumpfer grosser Zahn, welcher nach unten und hinten vorragt.

Die grossen, nach vorn zwischen das 7. und 6. Beinpaar eingeschlagenen Gonopoden (Abb. 1 und 2) sind nach ihren Beziehungen schon oben besprochen worden. Das reichlich beborstete Präfemur (Abb. 2) bleibt erheblich kürzer als das nackte Femur. Die Grenze zwischen beiden wird aussen durch eine abgekürzte Leiste (l) bezeichnet, und statt einer Zwischenhaut zeigt sich in der inneren Einknickung ein Zapfen (el), der eine elastische Feder vorstellt, welche zwar eine Drehung beider Glieder gegen einander gestattet, sie aber zugleich passiv in ihre gewöhnliche Lage zurückschnellen lässt.

Das Femur ist gebogen nach endwärts, stark erweitert und aussen durch eine kräftige Längsrippe (k) ausgezeichnet, welche ungefähr die halbe Länge einnimmt. Eine scharfe Grenze zwischen dem Femur und den folgenden vier getrennten Endästen ist nicht vorhanden, sie wird überhaupt nur durch eine einseitige Einschnürung angedeutet und durch eine gebogene Leiste, welche etwas vor jener bei x ausläuft. An diese Leiste schliesst sich ein säbelartig gebogener und spitz endender Fortsatz an, den ich als Tibiotarsus (tt) betrachte, weil er die natürliche Fortsetzung des Femurs darstellt. Er besitzt hinter der Basis 2–3 kleine Zähnchen. Ihm gegenüber gleich hinter der Einschnürung erheben sich dicht neben einander eingewurzelt zwei postfemorale Fortsätze (pr 1 und 2), beide spitz auslaufend, aber von verschiedener Länge.

Zwischen den Basen von Tibiotarsus und postfemoralen Spiessen ragt der grösste Endast, das der Länge nach vom Spermagang (r) durchsetzte Solänomerit (sl) heraus, ebenfalls säbelig gebogen, in der Mitte stumpfwinkelig vortretend, in der Endhälfte keulig verdickt und am Ende selbst etwas eingekrümmt. Innen zieht sich in der Endhälfte des Solänomerit eine Längsrippe hin (ka, Abb. 3) und unter ihr eine Längsmulde. Der Spermagang mündet in einem kleinen Vorsprung des Endlappens, hinter welchem ein viel kleineres Nebenläppchen vorragt.

Hoplatessara Verh. Walestessara, n. subg.

Die im folgenden beschriebene Form hat mich veranlasst, *Hoplatessara* in zwei Untergattungen zu zerlegen, und zwar unterscheide ich *Walestessara* n. subg. von *Hoplatessara* s. str. einerseits durch die unten beschriebenen Längswülste am Kopfe des ♂, andererseits durch die Gonopoden. Was aber die letzteren betrifft, so endigt das Solänomerit bei *Walestessara* einfach (Abb. 4), während es bei *Hoplatessara* am Ende in drei Zipfel zerfällt und der Spermagang in den mittleren dieser in grossem Bogen abbiegt, ausserdem bildet der Tibiotarsus bei *Hoplatessara* eine Keule auf langem Schaft, während er sich bei *Walestessara* (Abb. 5) als ein gedrungener Schild darstellt, der viel länger ist als sein kurzer Schaft und hinter der Mitte durch eine taschenartige Grube ausgezeichnet. Von *Leucotessara* sind beide Untergattungen von *Hoplatessara* besonders dadurch unterschieden, dass der Tibiotarsus keine Anzeichen eines Zerfalles in zwei Abschnitte mehr besitzt.

H. (Walestessara) cruciata, n. sp.

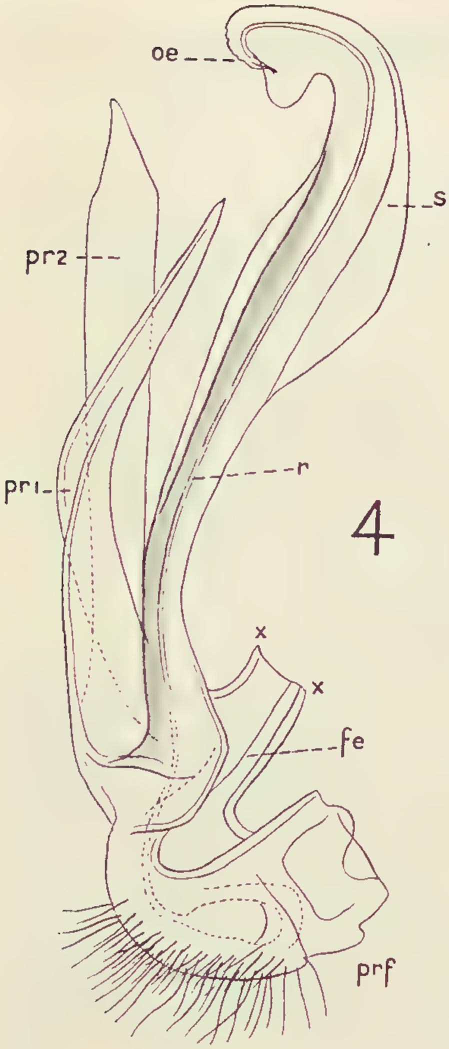
♂. 48 mm. lg., Beine schwarz mit gelblicher Ringelung, der gelblichweisse Rücken mit drei vom Kopfe bis zum Telson ziehenden, schwarzen Längsbinden, einer schmäleren mittleren und zwei breiteren innen von den Längswülsten. Diese seitlichen Binden sind an den Protergiten noch breiter als an den Metatergiten. Im Bereich der an den meisten Ringen recht tiefen Querfurchen gibt es dunkle Querstreifen, durch welche die Metatergite schwarze Kreuze erhalten, Rücken vorwiegend matt, dicht fein gerunzelt. Seitenwülste deutlich entwickelt, aber am 2. und 3. (4.) Ringe kommen statt ihrer Seitenflügel von ohrartiger Gestalt vor, die am 2. Ringe hinten abgerundet. Die meisten Seitenwülste ragen hinten nicht vor, nur am 15.–17. bilden sie hinten eine schwache Ecke. Die tiefen Seitenfurchen erreichen vorn die Nähte nicht. Diese sind tief, zeigen aber keine deutliche Kerbung.

Poren der Wehrdrüsen, von typischer Verteilung, im hintersten Drittel der Seitenwülste in kleinen Gruben gelegen, Telson dem von *Giganotowales* ähnlich.

Ein auffallendes Merkmal des ♂ besteht in zwei rippenartigen Längswülsten des Oberen Kopfes, welche innen von den Antennengruben und parallel streichen, vorn am Scheitel beginnen und sich fast bis zum Labrum herabziehen. Zwischen den Längswülsten einige grobe Längsrunzeln, unter den Antennengruben Längseindrücke.

1. Beinpaar des ♂ mit den Hüften dicht zusammen gerückt, Femur innen mit kräftigem Zapfen, der 1½ mal länger als breit, aussen ist das Femur stark gebogen. Zwischen den Hüften am 4. Beinpaar des ♂ springt nach unten eine hohe, abgerundete-dreieckige Platte vor.

Wie man aus Abb. 4 ersieht, ist das Femur der Gonopoden äusserst kurz und gegen das Präfemur wenig abgesetzt. Das sehr lange und starke Solänomerit (sl) ist etwas fragezeichenartig gekrümmt, hinter der Mitte blattartig erweitert und am Ende zurückgebogen. An diesem Ende mündet auch in einem kleinen Fortsatz der Spermagang und davor ist ein halbkreisförmiger Lappen zurückgebogen. Die beiden postfemoralen, spitz auslaufenden Fortsätze sind zwar stark entwickelt, bleiben aber doch kürzer als das Solänomerit. Der längere und dickere von ihnen



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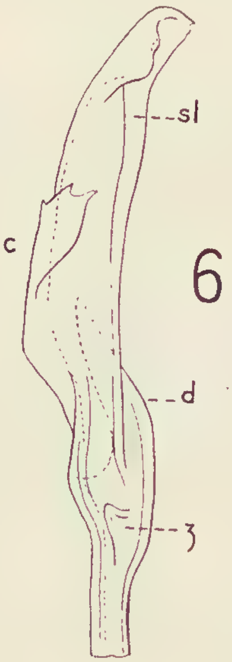

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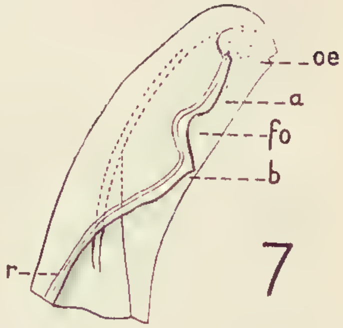

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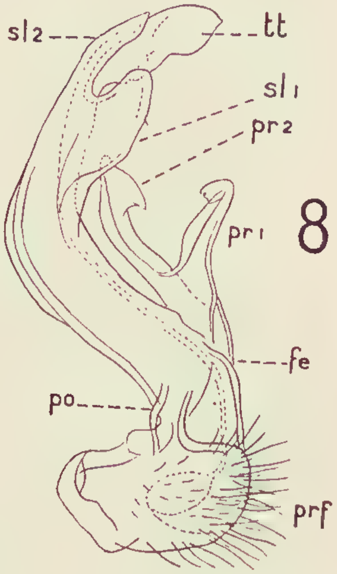

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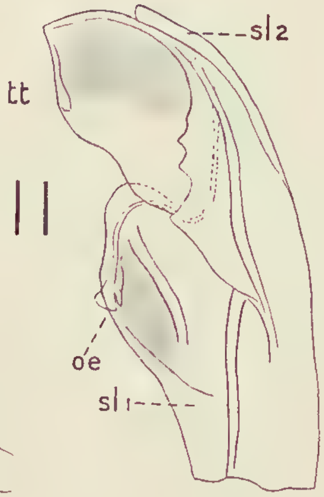

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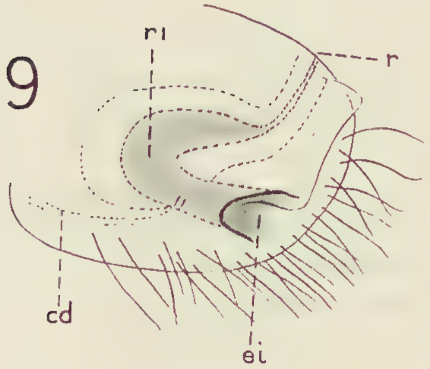

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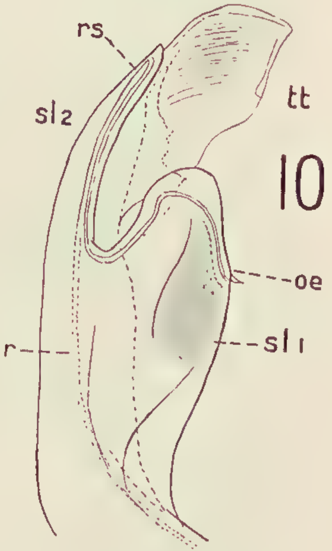

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Abb. 4.—*Hoplatessara cruciata*, n. sp.

4. Telopodit eines Gonopod, von aussen gesehen, ohne den bei x, x abgebrochenen Tibiotarsus, Bezeichnung wie in Abb. 1 und 2: × 56.

Abb. 6 und 7.—*Parwalesoma* n.g. *castaneum*, n. sp.

6. Endhälfte eines Gonopod. Ansicht von innen: × 56. sl, Solänomerit.
7. Endteil des Solänomerit mit der Mündung des Spermaganges (oe), a, b, vorragende Lamelle: × 125.

(pr2) bleibt fast gerade, während der kürzere und dünnere (pr1) nicht nur stark gebogen ist, sondern auch in der Mitte längs eingeschnürt. Der Tibiotarsus, welcher in Abb. 5 vom übrigen Gonopod abgetrennt und isoliert dargestellt wurde, hat einige Aehnlichkeit mit einer Muschelschale, indem er schon gleich hinter seinem Ansatzhals (x, x) plötzlich bedeutend verbreitert ist. Das abgerundete Ende ist mit einem starken Zahn (d) bewehrt und vor diesem ragt ein zarterer Fortsatz (f, f1) mit mehreren Spitzchen heraus. Etwas hinter der Mitte ist der Tibiotarsus innen durch eine Grube (fo) ausgezeichnet, welche einseitig von Leisten begleitet wird. Auch scheint es mir, als wenn sich an diese Grube noch eine kleine Höhlung anschliessen würde, vielleicht zur Spermaaufnahme dienlich. Hinter dem Hals sah ich an der Basis des Tibiotarsus, und zwar dem Solänomerit zugekehrt, auch noch einen gezahnten Höcker (z).

Parwalesoma, n.g.

Nach dem Bau des Rumpfes könnte man diese Form an *Solänodolichopus* anschliessen, und hinsichtlich des langen Femurabschnittes an den Gonopoden herrscht Uebereinstimmung mit *Solänodolichopus* und *Aulacoporus*. Aber von diesen beiden Gattungen weicht *Parwalesoma* ab durch ein im Endteil löffelartig ausgehöhltes Solänomerit (Abb. 6 und 7), wobei die Endstrecke und Mündung des Spermaganges sich in dem gebuchteten Rande des Löffels befindet.

Aulacoporus ist übrigens durch den Besitz von Seitenfurchen an fast allen Rumpfringen leicht unterscheidbar von *Parwalesoma*, dem diese Seitenfurchen an den meisten Ringen fehlen. Die Gonopoden von *Solänodolichopus* sind vor denen von *Parwalesoma* dadurch ausgezeichnet, dass das Ende des Spermaganges sich in einem vorragenden Lappen befindet, und ausserdem zwei Fortsätze diesen Mündungsklappen flankieren. Ferner ist das Ende des Femurs bei *Solänodolichopus* scharf abgegrenzt, während das bei *Parwalesoma* (Abb. 6) nicht der Fall ist. Nahe verwandt ist diese Gattung hinsichtlich der Gonopoden auch mit *Walesoma* (Abb. 16 und 17 in Records of Austral. Museum, 1928, Vol. xvi, Taf. 8), aber diese Gattung besitzt Seitenwülste und Seitenfurchen.

P. castaneum, n. sp.

♀ 44 mm., ♂ 54 mm. lg., Körper dunkelbraun, ohne helle Zeichnungen, aber die Prozonite mehr oder minder rötlichbraun, Beine braun. Zwischen den Hüften des 4. Beinpaares des ♂ eine fast halbkreisförmige Platte. Seitenfurchen fehlen an den meisten Ringen, nur am 3. und 4. sind gebogene Furchen vorhanden, und am 2. eine fast gerade, begleitet von Seitenleiste. Rücken ziemlich glänzend und fast glatt. Scheitel tief gefurcht, Clypeus grob punktiert, Kopf beim ♂ ohne besondere Auszeichnung, Poren der Wehrdrüsen an den meisten Metazoniten etwas hinter der Mitte gelegen. Querfurchen sehr deutlich, aber weit oberhalb der

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Abb. 8-11.—*Myallosoma furculigerum*, n. sp.

8. Telopodit eines Gonopoden, von aussen gesehen: × 56. prf, Präfemur; fe, Femur; tt, Tibiotarsus; sl_1, sl_2, Aeste des Solänomerit; pr1, pr2, Gabelast auf dem Femur; po, Brücke zwischen Femur und Präfemur: × 56.
9. Stück des Präfemur mit der Basalgrube (r1) des Spermaganges, von innen gesehen. r, cd, Endkanal der Coxaldrüse; ei, Eingang in die Spermagrube und für die Einführung des Coxalhornes: × 125.
10. Endhälfte des Gonopoden-Telopodit, von aussen gesehen. rs, grosse Schleife des bei; oe, mündenden Spermaganges: × 125.
11. Dasselbe, Ansicht von innen: × 125.

Poren aufhörend, Telsonfortsatz gerade nach hinten gerichtet, am Ende tief eingebuchtet und daher zweispitzig. Analklappen innen nur schwach gefurcht, Subanalplatte einfach.

Femur am 1. Beinpaar des ♂ mit einem etwas nach endwärts gebogenen Fortsatz, der etwas länger als breit ist, Femur aussen stark gebogen.

Coxa der Gonopoden fast so lang wie das sehr lange Femur, am Ende nur dem zurückgebogenen Telopodit gegenüber mit Borstengruppe. Das Präfemur nicht länger als breit, sehr dicht und lang beborstet, am Ende nur innen gegen das Femur scharf begrenzt. Femur in seiner ganzen Länge nackt, zugleich schlank und am Ende gegen das Solänomerit ohne scharfe Grenze. Aber das Ende des Femur wird durch eine Erweiterung bezeichnet (Abb. 6), an welcher sich ein kleiner dreieckiger Zahn (z) befindet. Neben demselben beginnt das lange Solänomerit, an dessen Basis sich von der anderen Seite ein kräftiger und spitziger, postfemoraler Fortsatz anschmiegt (d). Das Solänomerit besitzt einen ziemlich dünnen Hals, bleibt im mittleren Gebiet fast gleich breit, und verschmälert sich erst im Endgebiet. Dieses ist abgerundet und löffelartig ausgehöhlt (Abb. 7). Von den beiden, die Aushöhlung begleitenden Rändern ist einer fast gerade, der andere, in welchem zugleich die Endstrecke des Spermaganges verläuft, ist durch eine Bucht (fo) in einen Lappen (a) und ein Dreieck (b) abgesetzt. Der Lappen hört am Ende plötzlich auf, hier mündet der Spermagang, und dann zieht sich der Rand im Bogen zurück. Dem erwähnten postfemoralen Fortsatz gegenüber aber etwas weiter nach endwärts schlägt sich um das Solänomerit eine an seiner Basis stumpfwinklig vorspringende, am Ende aber in drei Spitzchen ausgezogene Lamelle (Abb. 6, c), welche ich als Ueberrest des Tibiotarsus auffasse.

Myallosoma furculigerum, n. sp.

Obwohl ich von dieser Art nur ein Bruchstück erhalten habe, nämlich Kopf und 1.–7. Ring, ist sie doch mit Sicherheit bestimmbar, weil die Gonopoden gut erhalten blieben.

Körper fast 3 mm. breit, graugelb, die Hinterränder der Tergite braun quergestreift. Rücken glatt und glänzend. Clypeus kräftig punktiert, Kopf des ♂ ohne Besonderheit. Nähte kräftig gekerbt, Querfurchen tief und von den Seitenfurchen nicht weit entfernt bleibend. Seitenwülste am 2. Ring hinten in dreieckigen Zipfel vorragend, auch am 3.–7. Ring hinten etwas eckig vortretend. Seitenfurchen sehr tief, rinnenartig, von der Naht etwas entfernt bleibend, Poren hinter der Mitte der Seitenwülste, von keiner Grube umgeben.

Hüften am 1. Beinpaar des ♂ dicht zusammenstossend, Fortsatz am Femur kurz und stumpf, breiter als lang, daher von hinten gesehen nur wenig vorragend, Bürste am Tarsus innen ziemlich locker, Zwischen den Hüften am 4. Beinpaar des ♂ eine breit abgerundete, weit vorragende Platte.

Die Gonopoden dieser Gattung sind dadurch ausgezeichnet, dass:

1. Präfemur und Femur annähernd gleich lang sind.

2. Das Femur erheblich kürzer als das Solänomerit.

3. Die beiden postfemoralen Fortsätze Y-förmig verbunden sind, also eine gemeinsame Basis haben.

4. Das Solänomerit am Ende in zwei Fortsätze zerfällt, einen kürzeren stumpfen (sl1, Abb. 8–10) und einen längeren spitzen, der Spermagang aber mit grosser Schleife zuerst durch den spitzen Fortsätz zieht, ehe er in den stumpfen gelangt und in diesem mündet.

5. Tibiotarsus und Solänomerit sind auf langer Strecke verwachsen, aber am Ende ragt der Tibiotarsus als breite Lamelle über die beiden Solänomerit-Fortsätze hinaus.

Myallosoma hamuligerum Verh. (1928) und *furculigerum*, n. sp., stimmen in allen diesen z.T. sehr auffallenden generellen Charakteren durchaus miteinander überein. Beide Arten lassen sich aber leicht unterscheiden sowohl nach der Körperfarbe als auch nach dem Bau der Gonopoden.

Bei *furculigerum* sind die beiden postfemoralen Fortsätze am Ende hakig zurückgebogen, bei *Hamuligerum* nur einer derselben, während der andere breit und fast dreieckig erscheint. Bei *furculigerum* ist die Bucht zwischen den beiden Solänomerit-Fortsätzen breiter und mehr oval, der kürzere Fortsatz aber erscheint fast halbkreisförmig, bei *hamuligerum* dagegen ist diese Bucht eng und spitz, während der kürzere Fortsatz basalwärts eckig herausragt. Der Tibiotarsus besitzt bei *furculigerum* innen ein feines, gezähneltes Blatt und ist am abgeschrägten Endrand glatt, bei *hamuligerum* kommt ihm innen ein Längswulst zu, während er am abgeschrägten Endrand gezähnelt ist.

Bei *hamuligerum* besitzt das Sternit am 10. Beinpaar-segment des ♂ zwischen den Hüften zwei Zapfen. Wie sich in dieser Hinsicht *furculigerum* verhält, ist leider ungewiss.

Coxalorgane und Coxaldrüsen.

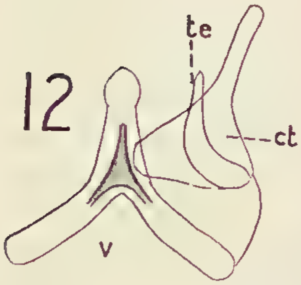
Dass in den Hüften der Gonopoden Coxaldrüsen vorkommen, habe ich bereits für mehrere Gattungen der Polydesmoideen nachgewiesen, die den verschiedensten Familien angehören. Unter den australischen Strongylosomiden sah ich sie besonders deutlich bei *Myallosoma*, und namentlich erwähne ich diese Gattung hier deshalb, weil ich bei ihr sowohl die Einmündungen der Kanäle der Coxaldrüsen in den Spermagang genau feststellen konnte (Abb. 9), als auch die basale Erweiterung desselben. Bekanntlich sind die Coxalorgane oder Coxalhörner (coa, Abb. 2) durch ein verjüngtes und hakig eingebogenes Ende ausgezeichnet, welches dazu bestimmt ist, den erweiterten, basalen Anfang des Spermaganges zeitweise zu versperren.

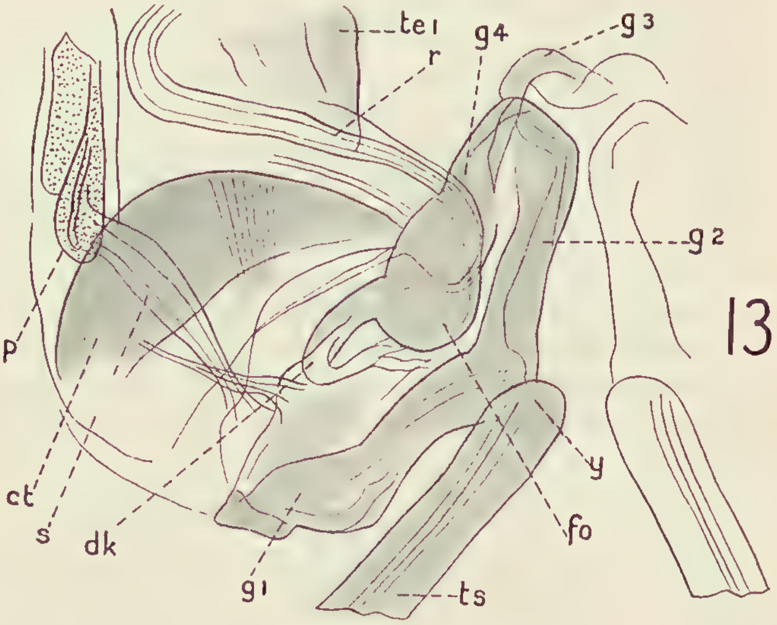
Früher nahm man lediglich an, dass diese Absperrung sich auf ein flüssiges Sperma beziehe, dessen basales Abfliessen durch Einstecken der Coxalhörner verhindert werden solle. Ich habe aber dann darauf hingewiesen, dass der Spermagang ein Capillarrohr ist, in welchem das aufgenommene Sperma durch Adhäsion haftet, sodass die vorausgesetzte Tätigkeit der Coxalhörner überflüssig erscheint.

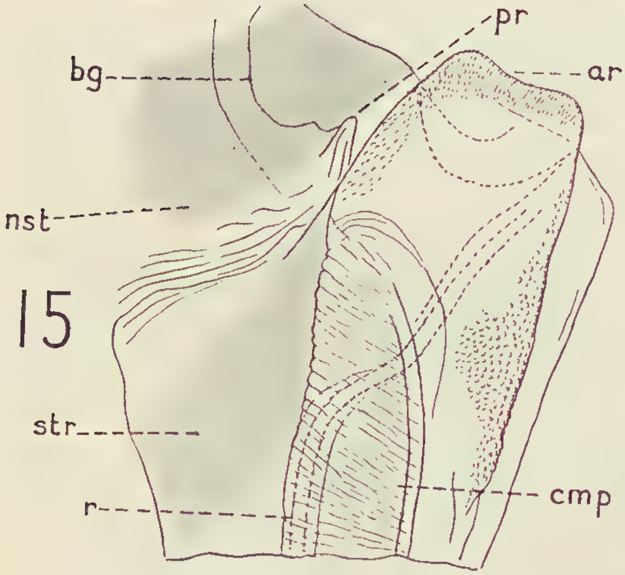
Durch die Entdeckung der Coxaldrüsen erhielten die Verhältnisse eine ganz neue Beleuchtung, denn jetzt ergab sich eine ganz deutliche Rolle für die Coxalhörner, nämlich die von Regulatoren für den Drüsensaft, welcher bei der Copula das Sperma aus den Spermakanälen in die weiblichen Cyphopoden überspült.

Bei *Myallosoma* (Abb. 9) sehen wir, dass der enge Spermagang im Präfemur sich plötzlich erweitert zu einer Höhlung (r1). Diese aber biegt sich hakenartig um und mündet dann (ei) in einem verhältlich kleinen Grübchen, gerade *gross genug, um das Ende des Coxalhornes aufzunehmen.* Die Mündung des Coxaldrüsenkanals aber liegt zwischen der Biegung der Höhlung und diesem Grübchen. Wird also das Grübchen vom Coxalhorn geschlossen, dann kann der Saft der Coxaldrüsen nur durch den Spermagang abfliessen und bewirkt somit die Austreibung des Spermas. Wenn aber das Coxalhorn sehr tief eingesteckt wird, dann ist es wahrscheinlich imstande, auch die Mündung der Coxaldrüse zu versperren, sodass damit also eine Regulierung des Saftzuflusses der Coxaldrüsen herbeigeführt werden kann.

Meine neue physiologische Erklärung der Polydesmoideen-Gonopoden macht uns jetzt auch die bisher so rätselhaften Rhachidesmiden Amerikas verständlich.







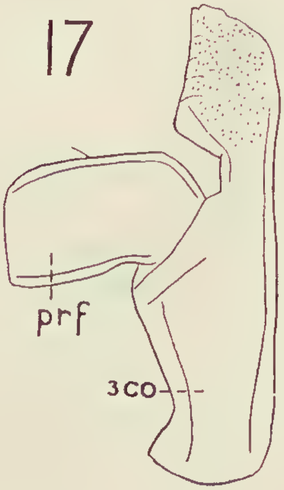


Abb. 12-13, 15, 17.—*Ainigmabolus* n.g. *chisholmi*, n. sp.

12. Sternit der vorderen Gonopoden und daran angelehnt ein vorderer Gonopod (letzterer schematisiert): × 10.
13. Sternit (g1-g4) und Stätzen (ts) der hinteren Gonopoden, sowie deren Coxit (ct) und Basis des Telopodit (te1). r, Spermagang; fo, Spermagrube; dk, Endteil des Kanals der Coxaldrüse; s, Verbindungsstrang zwischen Sternit und Gonopod: × 56. (Nach einem Macerationspräparat.)
15. Wärzchenfeld (ar), Streifenfeld (str), und geritztes Feld (cmp), nebst Nachbarschaft aus dem hinteren Gonopod, Ansicht von vorn: × 125.
17. Coxa und Präfemur aus dem 3. Beinpaar des ♂: × 56.

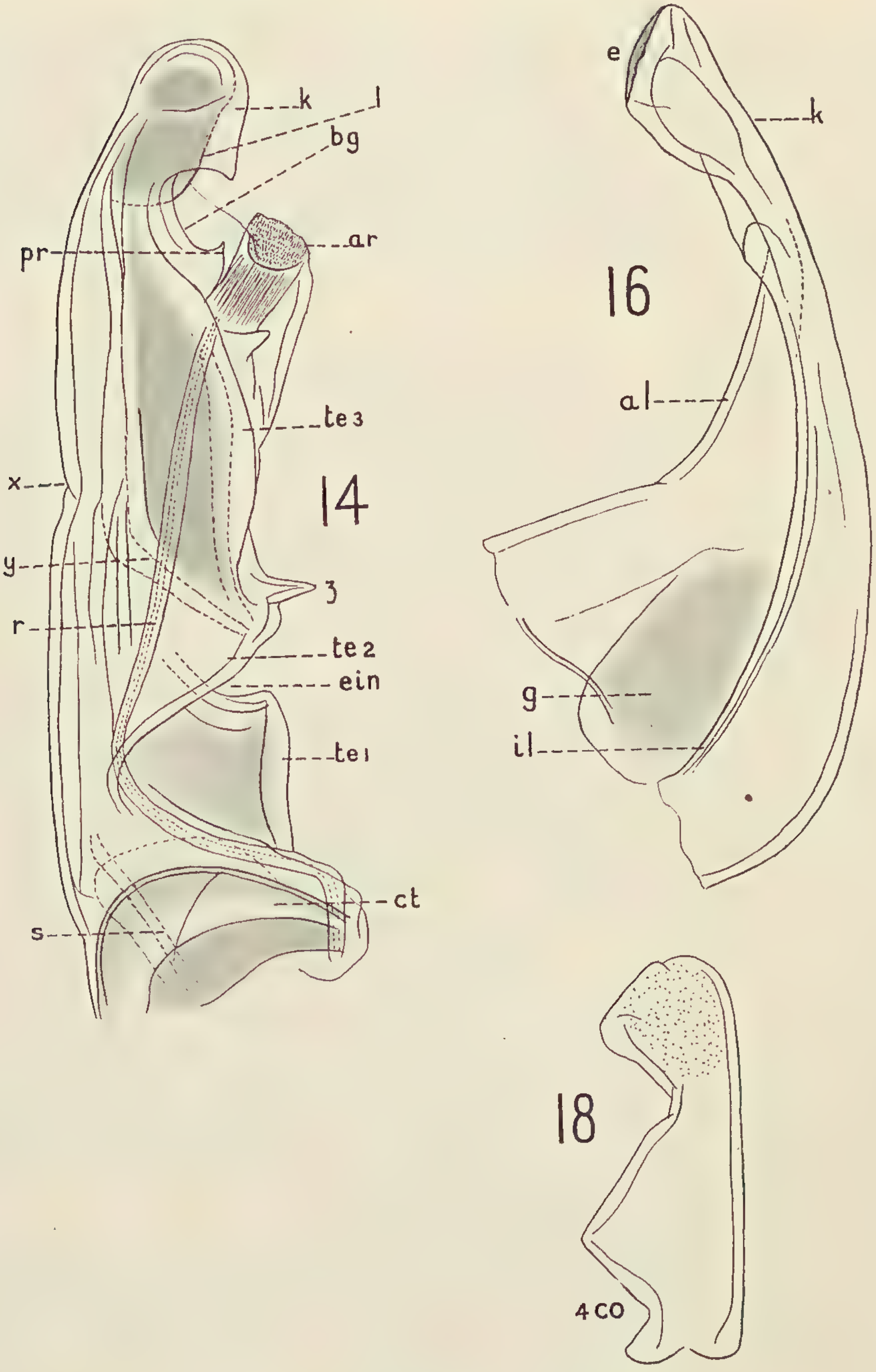


Abb. 14, 16, 18.—*Ainigmabolus* n.g. *chisholmi*, n. sp.

14. Hinterer Gonopod in natürlichem Zustande, Ansicht von hinten. ct, Coxit; te1-te3, Abschnitte des Telopodit; r, Spermagang; ar, Wärzchenfelt: × 56.
16. Ein Coxit der vorderen Gonopoden, ohne seine Basis. k, Kopf des Coxitfortsatzes; il, innerer; al, äusserer Lamellenrand; g, Grube in welcher das Telopodit eingelenkt sitzt: × 56.
18. Coxa aus dem 4. Beinpaar des ♂: × 56.

Es ist dies bekanntlich die einzige Familie der Ordnung, bei welcher an den Gonopoden die Coxalhörner fehlen. Wenn diese aber nach der früheren Theorie als "Nachstopfer" für den Spermagang notwendig sein sollten, dann war es rätselhaft, wie sich die Rhachidesmiden behelfen sollten. Jetzt sind aber die Gonopoden-Verhältnisse auch bei den Rhachidesmiden nicht mehr unverständlich, denn statt der fehlenden Coxalhörner besitzen sie eine sehr runde basale Spermagrube, welche dicht mit Tastborsten ausgekleidet ist. Hier findet also keine Regulierung des Drüsensaftes statt, sondern derselbe fliesst ungehindert in die grosse Grube und wird hier von den vielen Borsten wie von einem Schwamm festgehalten.

Ueber die Gonopoden der Trigoniuliden und Ainigmabolus n.g. chisholmi n. sp.

Die Spiroboloidea, obwohl durch zahlreiche Gattungen und Arten und viele stattliche Formen vertreten, sind noch immer eine der am wenigsten bekannten Gruppen der Diplopoden, was seinen Hauptgrund darin hat, dass sie in Europa vollständig fehlen. Grosse Unklarheit herrscht vor allem hinsichtlich der Abgrenzung der Familien, wie man aus den bekannten Arbeiten von Attems und Brölemann ersieht. In Kükenthals Handbuch der Zoologie, 4. Bd., Leipzig, 1926, unterschied Attems (im Anschluss an Brölemann) 5 Familien, Spiroboliden und Rhinocriciden, welche die Spirobolideae, sowie Trigoniuliden, Pachyboliden und Spiromimiden, welche die Trigoniulideae bilden.

Die hier zu besprechende neue Gattung gehört zu den Trigoniuliden, deren wesentliche Charaktere in den Gonopoden, und zwar hauptsächlich den hinteren, liegen. Attems sagt von den Trigoniuliden: "Das Coxit der Hinteren Gonopoden besteht aus zwei im rechten Winkel zu einander stehenden Stäben und dazwischen gespannten Membranen. Die Tracheentasche ist gelenkig abgesetzt. Das Telopodit ist deutlich vom Coxit getrennt. Eine deutliche Gliederung des Telopodits ist selten sichtbar. Die zwei Blasen im hinteren Gonopod und ein fingerförmiger Chitinzapfen meist vorhanden.

"Coxit und Telopodit der vorderen Gonopoden kurz und breitblattig, selten einige Teile länger und schlanker ausgezogen. Scobinae kommen nur ausnahmsweise vor."

In Abb. 13–15 habe ich die hinteren Gonopoden von *Ainigmabolus* n.g. dargestellt, und zwar Abb. 13 nach einem macerierten und entkalkten Objekt, wobei stark abgeblendet werden musste, um die einzelnen Elemente möglichst deutlich hervortreten zu lassen. Diese Gattung kann nicht zu den Spirobolidae gehören, weil die hinteren Gonopoden durch ein kräftiges Sternit verbunden sind, was aber die Abgrenzung der Pachybolidae und Spiromimidae betrifft, so erscheint mir dieselbe bis jetzt durchaus fragwürdiger Natur.

Aber auch die eben zitierte Diagnose von Attems gibt bezüglich der hinteren Gonopoden zu Zweifeln Anlass, und zwar sogar dann, wenn man sie auf seine eigenen Abbildungen anwendet. Die Schwierigkeiten liegen in der vergleichenden Morphologie der hinteren Gonopoden und ihres Sternites, gesteigert durch den verwickelten Bau dieser Organe, welche bisher nicht gründlich genug studiert worden sind.

Vergleicht man die hinteren Gonopoden der Spiroboliden mit denen der Trigoniuliden, dann ist eine Stelle an denselben hinsichtlich der Homologie unbedingt klar, nämlich das Gelenk zwischen den Stützen (= Tracheentaschen) und den Gonopoden, in Abb. 13 (wo nur die Endhälften der langen Stützen eingezeichnet wurden), mit y bezeichnet. Diese Stellen sind bei den Spiroboliden weit auseinander gerückt, bei den Trigoniuliden dagegen einander genähert, weil die Gonopoden durch ein compliciertes Gerüst (g1–g4) mit einander verbunden sind, welches bei den Spiroboliden vollständig fehlt. Ganz unabhängig davon, wie man die einzelnen Abschnitte der Gonopoden auffassen will, ist jedenfalls das eine sicher, dass *die hinteren Gonopoden der Trigoniuliden* (im Vergleich mit denen der Spiroboliden), *die primitiveren* oder ursprünglicheren sind, *weil sie eine die Gonopoden verbindende Basis haben und überhaupt gegliederter sind* und damit den gewöhnlichen Beinen, aus welchen wir alle Gonopoden abzuleiten haben, viel näher stehen.

Da nun dieses verbindende und basale Gerüst der hinteren Gonopoden bei *Ainigmabolus* besonders gut entwickelt ist, verdienen diese Organe bei dieser Gattung auch eine genauere Würdigung.

Nach den bisherigen Anschauungen müssen wir die in Abb. 13 mit g1–g4 bezeichneten paarigen Teile als Sternit-Hälften bezeichnen, wobei noch zu bemerken ist, dass sie nur durch die kurzen distalen Stücke g3 direkt elastisch verbunden sind, sonst aber nur durch Häute verknüpft werden. Am stärksten sind die Teile g1 und g2 ausgebildet, welche eigentlich einen einzigen länglichen Arm vorstellen, der stumpfwinklig geknickt ist und als Hauptarm, brachius major, bezeichnet werden kann. Dem stumpfen Winkel gegenüber liegt auch die gelenkige Verbindung (y) mit der langen Stütze. Hinter den distalen Stücken g3 setzt sich der Hauptarm nach aussen schräg fort, und wird dann durch eine plötzliche Knickung getrennt von dem wieder basal zurückgebogenen und basalabwärts erweiterten Nebenarm, *brachius minor*, g4. Aussen vom Nebenarm bemerkt man ein grosses, quer gestelltes, fast mondsichelförmiges Sklerit, welches sowohl gegen die geschilderten Sternitstücke, als auch gegen den übrigen Gonopod scharf abgegrenzt ist und daher als Coxit (ct) betrachtet werden kann. Aussen neben dem Coxit lagert eine Verdickung (p), welche durch starke Punktierung ausgezeichnet ist. Von dieser Verdickung zieht ein Strang (s) schräg durch das Coxit und gegen einen Ausläufer des Sternit, während dieser durch einen 2. schmäleren Strang auch mit dem Coxit verbunden ist.

Unschwer kann man im Telopodit des hinteren Gonopod einen Spermagang erkennen, und dieser zieht im Bogen innen neben dem Coxit gegen das Sternit und bildet neben und zwischen Haupt- und Nebenarm eine blasige Erweiterung (fo), in welche von grundwärts und aussen der umgebogene und in seiner Endstrecke erweiterte Kanal der Coxaldrüse (= Prostata n. Attems) eintritt. Die wesentlichsten Merkmale des coxosternalen Gebietes der hinteren Gonopoden habe ich hiermit besprochen. Prüft man aber diese für *Ainigmabolus* geltenden Verhältnisse mit der oben nach Attems zitierten Charakteristik der Trigoniuliden, dann wird mir vermutlich kaum jemand widersprechen, wenn ich erkläre, dass diese Charakteristik auf *Ainigmabolus* angewandt nicht zu verstehen ist und dass man nur vermittelst verschiedener Abbildungen Beziehungen zwischen den *Trigoniuliden*-Gattungen feststellen kann.

Von den "Blasen" der hinteren Gonopoden, welche Attems besprochen hat, ist bei *Ainigmabolus* jedenfalls nur eine vorhanden (fo, Abb. 13), aber es ist leicht möglich, dass ein Teil des beschriebenen Nebenarmes (g4) für eine Blase angesprochen wird.

Der "fingerförmige Chitinzapfen in Verbindung mit den Blasen" soll nach Attems "ein Druckapparat zur Entleerung der Blasen" sein. Was er mit dem

"Chitinzapfen" gemeint hat, kann man nur mit Hülfe seiner Abbildungen feststellen, aber es ist mir durchaus unklar, welches Stück von *Ainigmabolus* ich mit diesem "Chitinzapfen" homologisieren soll. Da ich nun kein Anfänger im Studium der Diplopoden mehr bin, so müssen doch Kollegen, welche mit denselben weniger vertraut sind, hinsichtlich dieser besprochenen Verhältnisse noch ratloser werden. Wie man sieht, hapert es mit der vergleichenden Morphologie der Gonopoden bei den *Spiroboloidea* noch so sehr, dass ganz neu aufgebaut werden muss.

Wenn auch nicht aus morphologischen, so kann ich wenigstens aus physiologischen Gründen in dem beschriebenen Sternitteil g4 ein Gebilde erblicken, was man allein auf Attems "Chitinzapfen" beziehen kann. Trotzdem vermag ich in diesem Sklerit "einen Druckapparat zur Entleerung der Blasen" nicht zu erblicken, halte vielmehr diese ganze Anschauung von Attems für verfehlt. *Ein mechanischer Druck auf die Blasen ist nämlich durchaus überflüssig*, weil (wie wir schon im vorigen Strongylosomiden-Kapitel gesehen haben), das in den Spermagang aufgenommene Sperma bei Bedarf aus ihm *durch das Sekret der Coxaldrüsen entfernt wird.* Eine andere Frage aber ist die, ob nicht als physiologischer Ersatz für die oben besprochene regulatorische Tätigkeit der Coxalhörner der Polydesmoidea, bei den Trigoniuliden im coxosternalen Apparat irgend eine Sperrvorrichtung gegeben ist, durch welche der Saftzuffus der Coxal drüsen aufgehalten werden könnte. Etwas Sicheres kann ich in dieser Hinsicht vorläufig nicht feststellen, nur will ich auf die Möglichkeit hinweisen, dass der angedeutete Sperr-Effekt dadurch herbeigeführt werden könnte, dass im coxosternalen Gerüst durch Kontraktion ein Druck in der Weise ausgeübt würde, dass das mondsichelförmige Coxitstück (ct, Abb. 13) in die grosse Bucht eingetrieben wird, welche sich zwischen dem Endstück des Coxaldrüsenkanales und der gebogenen basalen Strecke des Spermaganges befindet.

Um noch einmal auf die Pachybolidae und Spiromimidae zurückzukommen, betone ich besonders, dass *Ainigmabolus* schon deshalb nicht zu diesen beiden Familien gehört, weil denselben der sogenannte "fingerförmige Chitinzapfen" der hinteren Gonopoden vollständig fehlt. Indem ich mich mit *Ainigmabolus* auf Attems Schlüssel der Trigoniuliden-Gattungen, 1926, beziehe, sei folgendes festgestellt: Die Poren der Wehrdrüsen befinden sich vor den Nähten der Diplosomite, und diese Nähte sind am Rücken oberhalb der Poren erlöschen. Zacken oder Zähne kommen an den Metazomiten nicht vor. Bei den unter 4b aufgeführten Gattungen ist das "Telopodit der hinteren Gonopoden ungegliedert", während es nur bei der Ostafrikanischen Gattung *Metiche* Att. als "2gliedrig" beschrieben worden ist.

Betrachten wir meine Abb. 14 für *Ainigmabolus* und vergleichen dieselbe mit Abb. 108 für *Metiche bravensis* (Silv.) Att. auf Taf. 6 in Attems Myriapoden der Kilimandjaro-Exped. Sjöstedts in Deutsch-Ostafrika, Stockholm, 1909, dann ist eine Aehnlichkeit im Telopodit der hinteren Gonopoden unverkennbar, vor allem aber stimmen beide Formen darin überein, dass sie innen hinter dem Basalteil des Telopodit eine tiefe Einschnürung besitzen, in Abb. 14 mit *ein* bezeichnet, während Attems sie durch ein Sternchen (*) markiert hat. Auf dieser Einschnürung beruht die Erklärung der Zweigliedrigkeit der Telopodite, hinsichtlich welcher diese beiden Gattungen übereinstimmen. Bei *Ainigmabolus* kommt aber noch eine zweite Absetzung am Telopodit vor, und diese besteht in einer Schrägleiste (y, Abb. 14) und einer Einschnürung (x) am Aussenrand, sodass man am Telopodit von *Ainigmabolus drei Abschnitte* unterscheiden kann, einen *präfemoralen* zwischen s und ein, einen *femoralen* zwischen ein und x, und ein Resttelopod, also Tibiotarsus (te3), hinter x. Eine Andeutung der Grenze xy findet sich aber auch bei *Metiche.*

Im Sternit der hinteren Gonopoden sind dagegen *Ainigmabolus* und *Metiche* sehr unähnlich, da letztere Gattung in der Mediane des Sternit nicht zerspalten ist, sondern Querspangen besitzt. Ferner kommen *Ainigmabolus* am 4. und 3. Beinpaar des ♂ mächtige Coxalfortsätze zu (Abb. 17 und 18), während diese bei *Metiche* ganz fehlen.

Trigoniulus ist nicht nur die bei weitem artenreichste Gattung dieser Familie, sondern bei ihr sind auch viele Arten untergeschlüpft, deren Gonopoden mehr oder minder schlecht bekannt sind.

Im genannten Schlüssel gab Attems unter 6 folgenden Gegensatz:

(*a*) "Innenarm der hinteren Gonopoden dicht und fein behaart."

Trigoniulus.

(*b*) "Innenarm der hinteren Gonopoden unbehaart, zuweilen fehlend."

Eucarlia, Chersastus, Spirostrophus u.a.

Dieser Gegensatz ist zur Heraushebung von *Trigoniulus* ganz ungenügend. Was zunächst den "Innenarm" betrifft, so ist es derjenige Abschnitt, welchen ich in Abb. 14 und 15 bei *Ainigmabolus* mit *ar* bezeichnet habe. Um eine "Behaarung" handelt es sich übrigens gar nicht, sondern um ein Feld, welches durch eine *sehr dichte, warzige Struktur* ausgezeichnet ist, wobei die mikroskopischen Wärzchen allerdings hier und da in kleine Spitzchen ausgezogen sein können. Ich will diesen Abschmitt als *Warzenfeld, area papillata* bezeichnen, und Zugleich erwähnen, dass sich an ihn nach innen eine Lamelle anschliesst, das *Streifenfeld, area striata* (str, Abb. 15), welches durch eine sehr dichte und äusserst feine Streifung ausgezeichnet ist.

Hinsichtlich des Vorkommens der *area papillata* stimmen also *Trigoniulus* und *Ainigmabolus* miteinander überein. Aber den hinteren Gonopoden von *Trigoniulus* fehlt der tiefe Einschnitt (ein, Abb. 14), durch welchen bei *Ainigmabolus* Präfemur- und Femurabschnitt gegen einander abgesetzt sind. Hinsichtlich *Trigoniulus* verweise ich z.B. auf Abb. 29 für *Trigoniulus* (*Spirostrophus*) *digitulus* Bröl. in RECORDS OF AUSTR. MUSEUM, Vol. 10, N. 6, 1913, bei welchem übrigens das Streifenfeld undeutlich ist, aber eine äussere Einschnürung (x) ebenfalls vorkommt. Ein anderer Unterschied zwischen *Trigoniulus* und *Ainigmabolus* betrifft die vorderen Gonopoden, indem deren Coxitfortsatz bei *Trigoniulus* gedrungen und breit gebaut ist, bei *Ainigmabolus* dagegen lang und fingerartig ausgezogen (Abb. 12 und 16). Ein Streifenfeld habe ich bei *Trigoniulus* auch nicht beobachtet, und verweise ich zum Vergleich auf Taf. xii in meinem Aufsatz 1928, RECORDS OF AUSTR. MUSEUM, Vol. 16, N. 2, wo die Struktur des Warzenfeldes des für *Tr. montium* und *richmondernus* Verh. zum Ausdruck gebracht wurde.

Um die Kenntnis der *Trigoniulus*-Arten hat sich Attems sehr verdient gemacht, und erwähne ich besonders seine indoaustralischen Myriapoden, *Archiv f. Nat.*, Berlin, 1914, in welchen er auf S. 338 einen Schlüssel für zahlreiche Arten beigebracht hat, wobei allerdings die Gonopoden noch nicht die ihnen gebührende Hauptrolle spielen. Er unterscheidet vielmehr drei Gruppen nach der Beschaffenheit der Hüften am 3. und 5. Beinpaar des ♂.

Die 3. und grösste Gruppe besteht aus Arten, bei welchen an diesen Hüften die Fortsätze fehlen, oder nur schwach entwickelt sind, zur 2. Gruppe gehört nur eine Art aus Madagaskar, bei welcher lange, aber gerade Hüftfortsätze vorkommen, Während die 1. Gruppe (aus 7 Arten) an den Hüften des 5. Beinpaares "grosse, hakig nach vorn gekrümmte Fortsätze" besitzt und "kleinere" an den Hüften des 3. und 4. Beinpaares. Hinsichtlich dieser Hüftfortsätze stimmt *Ainigmabolus* (Abb. 17 und 18) mit keiner der drei genannten *Trigoniulus*-Gruppen überein, denn wenn diese Gattung auch der 1. Gruppe jener am nächsten steht, so weicht sie doch auch von ihr dadurch ab, dass die Fortsätze am 3. und 4. Beinpaar viel stärker entwickelt sind als am 5., zugleich keulig nach aussen erweitert.

Indem ich schliesslich die wichtigsten Charaktere für die

Gattung **Ainigmabolus** mihi

zusammenfasse, ergibt sich folgende Charakteristik:

Poren der Wehrdrüsen *vor* den Nähten gelegen, und diese letzteren oberhalb der ersteren erlöschen. Diplosomite ohne gröbere Skulpturen, Telson ohne Fortsatz. Vorderkopf mit tiefer Medianfurche und vier grossen Supralabralgruben. Collumseiten abgerundet—spitzwinklig. 3. und 4. Beinpaar des ♂ mit grossen, keulig erweiterten Hüftfortsätzen, das 5. und 6. mit kurzen und stumpfen Hüftforsätzen. Coxite der vorderen Gonopoden in lange, fingerartige Fortsätze ausgezogen. Sternit der hinteren Gonopoden ein starkes, zweiteiliges Gerüst darstellend, an welchem die beiden Hauptarme (wie ein eingekrümmtes menschliches Bein) stark gegen einander eingeschlagen sind, während sich über dem kürzeren äusseren Arm eine blasige Erweiterung befindet, als Verbindung zwischen Spermagang und Coxaldrüsenkanal. An den hinteren Gonopoden selbst lassen sich 4 (5) Abschnitte unterscheiden, ein mondsichelförmiges Coxit, ein durch tiefen inneren Einschnitt abgesetztes Präfemur, ein dreieckiges Femur und schliesslich der Tibiotarsus. Dieser ist ausgezeichnet durch Warzenfeld und Streifenfeld, welche zusammen den sog. "Innenast" bilden, während dahinter ein durch tiefe Bucht abgesetzter Kopf das Endstück der hinteren Gonopoden bildet.

Ainigmabolus chisholmi, n. sp.

♂ 73 mm., mit 55 Rumpfringen; ♂ 76 mm., mit 56 R. juv.; ♂ 63 mm., mit 55 R.; bei diesem die Gonopoden erst höckerartig angelegt; ♀ 83 mm., mit 55 R. Körper vorwiegend dunkelbraun, aber eine Ringelung kommt dadurch zustande, dass an den Metazoniten vorn ein schwärzlicher und hinten ein braunrötlicher Ring aufeinander folgen, während die Prozonite mehr einheitlich graubraun bleiben.

Die zahlreichen Ocellen, welche von vorn nach hinten in 5 Reihen stehen, sind so dicht zusammengedrängt, dass sie grösstenteils sechseckig geworden sind, also Facettenaugen vortäuschen, zugleich sind die Cornealinsen abgeplattet.

Zwischen der Scheitelfurche und der Median furchendes Vorderkopfes bleibt ein furchenloser Zwisschenraum, der fast 1/3 der Kopflänge ausmacht. Scheitel geritzt-gerunzelt.

Collum an den abgerundeten Seiten einen Winkel von etwa 60° bildend, der Vorderrand seitlich mit tiefer Randfurche. Collum fein geritzt-gerunzelt.

An dem Rumpfringen werden die Nähte erst unterhalb der Poren erkennbar, sind aber recht deutlich erst in den Unterflanken. Eine feine und weitschichtige Längsfurchung tritt an den Metazoniten nur in den Unterflanken auf, während sich an den Prozoniten eine noch feinere, dichtere, und unregelmässigere geritzte Längsstreifung anschliesst.

Rücken mit feiner, aber dichter Punktierung, dazwischen hier und da auch feine Striche.

Telson ohne Fortsatz, Präanalsegment oben hinten abgerundet—stumpfwinkelig. Analklappen neben dem innenrande mit mehreren, unregelmässigen Eindrücken. Subanalplatte einfach.

Am 2. Beinpaar des ♂ die Hüften, welche mehr als doppelt so lang wie breit sind, mit dem Sternit verwachsen, Präfemur keulig, ungefähr so lang wie breit, Femur etwas breiter und Postfemur 1½ mal breiter als lang. Von den Fortsätzen an den Hüften des 3.–6. Beinpaares des ♂ (Abb. 17 und 18) ist schon oben die Rede gewesen.

Ueber die vorderen Gonopoden und ihr Sternit gibt Abb. 12 eine Andeutung. Das Telopodit ist also hornförmig und wird sehr weit überragt von dem langen Fortsatz der Coxite. Diese bilden eine Mulde (g, Abb. 16), in welcher das Telopodit eingelenkt ist. Innen und aussen erhebt sich das Coxit lamellenartig (al und il), und diese beiden Blätter vereinigen sich zur Bildung eines grossen, etwas gebogenen Fortsatzes, der am Ende keulig verdickt ist und im Ende der Keule (e) etwas ausgehöhlt.

Wenn man den Copulationsapparat aus seiner Tasche hervorpräpariert hat, sieht man zunächst nur die vorderen Gonopoden und ihr Sternit, während die *hinteren* nicht nur tief eingesenkt sitzen, sondern auch hinter den vorderen ganz versteckt liegen.

Mit diesen hinteren Gonopoden und ihrer vergleichenden Morphologie haben wir uns bereits näher oben beschäftigt, weil es diejenigen Organe sind deren Bau am verwickeltsten und deren Verständnis am schwierigsten ist, und welche zugleich für die Systematik die grösste Bedeutung haben.

Jetzt gehe ich noch auf diejenigen Verhältnisse ein, welche oben nicht berücksichtigt worden sind, und das gilt hauptsächlich für den Tibiotarsus. Wir sahen, dass sich von ungefähr in der Mitte der hinteren Gonopoden als Grenze zwischen Femur und Tibiotarsus eine Schrägleiste hinzieht (y, Abb. 14). Etwas hinter der Stelle, wo dieselbe innen ausläuft, ragt innen ein starker Zahn vor (z). Jederseits von dem beschriebenen Streifenfeld springt nach innen ebenfalls ein Zähnchen vor, von welchen eines (pr) auch in Abb. 15 sichtbar ist. Vor dem Warzenfeld, dessen Wärzchen in Abb. 15 übrigens nur zur Hälfte eingezeichnet wurden, fällt an der Vorderfläche ein Bezirk auf, den ich das geritzte Feld nenne (cmp, Abb. 15), *area insculpta*, ausgezeichnet durch zahlreiche feine Streifen, die unregelmässig verteilt und verschieden abgerissen sind, im Ganzen aber doch vorwiegend parallel laufen. Innen gehen sie nicht über eine Leiste hinaus und aussen bilden sie einen fein gekerbten Rand.

Was schliesslich den abgerundeten, kopfartigen Endteil des Telopodit betrifft (k, Abb. 14), welcher innen durch tiefe Bucht gegen das Streifenfeld abgesetzt ist, so springt er basal innen hinten eckig vor, während vorn an ihm eine Leiste (l) entlang läuft, welche neben der Bucht ausläuft.

A CONTRIBUTION TO THE PERMIAN-UPPER CARBONIFEROUS PROBLEM AND AN ANALYSIS OF THE FAUNA OF THE UPPER PALAEOZOIC (PERMIAN) OF NORTH-WEST BASIN, WESTERN AUSTRALIA.

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Introduction.

In a recent paper by Raggatt (1) a brief discussion of the fauna of the Upper Palaeozoic of North-West Basin, Western Australia, was given. In attempting to analyse the revised faunal lists more critically, it became necessary to examine the range of certain of the species in Eastern Australia, India, and adjacent regions. We were thus led to examine the arguments which have been put forward in determining the boundary between the Permian and Carboniferous Systems in those regions. We found that our conclusions had a bearing on the age of the Lower Gondwana rocks of South Africa and South America; hence some discussion on these beds is given. Incidentally, also we make reference to the Upper Palaeozoic glaciation. Thus, this paper may be considered as a contribution to the discussion inaugurated by Schuchert (2) and continued by David and Sussmilch (3).

The order of arrangement of this paper is that which was found necessary to achieve the object of determining the age of the Upper Palaeozoic beds of the North-West Basin. The New South Wales "Permo-Carboniferous" section and the criteria which have been put forward to determine the limits of the Permian and Carboniferous Systems in Australia are discussed first. Next, the bearing of this evidence on the age of the beds in India and Kashmir which contain Australian species is stated. Brief reference is then made to the Upper Palaeozoic succession in South Africa and South America. Finally, an analysis is made of the Western Australian fauna, mainly in terms of the range of species in India and Eastern Australia.

NEW SOUTH WALES.

The sequence of rocks in the Lower Hunter district of New South Wales which are commonly referred to as "Permo-Carboniferous", is as follows:

Series.	Stage.	Thickness in Feet.	
Upper Coal.	Newcastle.	400–1,500	Shales, sandstone, conglomerate, cherts, and coal seams. Fossil plants, *Phyllotheca*, *Vertebraria*, *Cladophlebis*, *Glossopteris*, *Gangamopteris*.
	Tomago.	500–3,000	Mainly shale, with thin beds of sandstone and coal seams. Same fossil plants as Newcastle Stage.
Upper Marine.	Mulbring.	1,000–2,000	Shale with calcareous concretion horizons. Glacial erratics near base. Marine fauna limited to about 30 genera, of which commonest are *Stenopora*, *Chaenomya*, *Warthia*, *Martiniopsis*, *Conularia*.
	Muree.	200–400	Sandstone, argillaceous and calcareous in places. Shales in middle part. Glacial erratics common. Fauna closely similar to Branxton Stage.
	Branxton.	2,000	Alternation of shales with beds like those of Muree Stage. Well marked *Fenestella* shale beds 1,550 feet above Greta Coal Measures. Glacial erratics common. Fauna includes several species of *Spirifer*, *Stenopora*, *Dielasma*, *Deltopecten*, *Martiniopsis*, and *Productus*.
Lower or Greta Coal.		100–300	Fine conglomerate, sandstone, shale with thick coal seams. Fossil plants, *Glossopteris*. *Gangamopteris*, *Noeggerathiopsis*, *Odontopteris*, and *Sphenopteris*.
Lower Marine.		4,800	Shales and sandstones with flows of basalt. Lochinvar glacial shales at base, 200 feet thick. Marine fossils include *Eurydesma*, *Conularia*, *Keeneia*, *Warthia*, *Martiniopsis*, *Aviculopecten*.

The stratigraphic column given above is that now recognized by the Geological Survey of New South Wales. Its only important difference from that given by David and Sussmilch (3, page 485) is in omitting the Dempsey Beds,[1] which have been proved by L. J. Jones to be a facies of the Tomago Coal Measures and not a separate stage.

The position of the glacial beds which occur throughout the sequence is given by David and Sussmilch (3, p. 485). These need not be redescribed, but some comments on the higher glacials are given. David and Sussmilch list two separate horizons in the upper part of the Upper Marine Series, one in the Branxton Stage and one in the Muree. This does not give quite a true picture of the higher glacials, since erratics occur almost continuously from about 200 feet above the Greta Coal Measures to about 50 feet above the Muree. The Muree can be distinguished from beds of similar lithology in the Branxton Stage only by the fact that it is overlain by a considerable thickness of shales.

Over most of the Sydney Basin the Upper Coal Measures pass upwards without angular unconformity into the overlying Lower Triassic Narrabeen Series, but unconformity exists between the Permian and Triassic on the Lochinvar dome in the Lower Hunter Valley. The basal glacial shales of the "Permo-Carboniferous" rest upon the underlying Kuttung Series (Carboniferous) without angular unconformity. Even where the Lower Marine Series is represented by volcanic rocks or is entirely absent, the contact between the Permo-Carboniferous and Kuttung is still angularly conformable, thus showing there was no orogeny in the interval between the deposition of the Kuttung Series and the Greta Coal Measures.

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[1] No doubt due to typographical error, unfortunately misspelled Kempsey in their paper. Kempsey is another locality in New South Wales where Upper Palaeozoic rocks occur.

Although there is no angular unconformity between the Kuttung and Lower Marine, the change from the one to the other clearly marks an important time break. The Kuttung Series is characterized by the *Rhacopteris* flora and the Permo-Carboniferous by the *Glossopteris* flora.[2] In discussing this, Walkom (9, p. 163) writes: "The *Glossopteris* flora in New South Wales is separated from the earlier flora of the Kuttung Series by an absolute break, not one of the species known from the Kuttung Series occurring in association with the *Glossopteris* flora."

The glacial deposits of the "Permo-Carboniferous" are all closely similar to each other, but differ from those of the Kuttung. They differ not only in environment and lithology, but the materials of which they are composed were derived from different sources. This point was stressed by Browne and Dun (4, pp. 198–206) in 1924. They put it forward as a good reason for placing the break between the Carboniferous and the Permo-Carboniferous at the base of the Lochinvar glacials. David and Sussmilch (3, p. 498) also stress the significance of this change in the glacials, and we discuss it again later in this paper.

The Kuttung is a freshwater series generally considered to be Middle Carboniferous[3] in age, but in the absence of marine strata this can scarcely be said to be proved. There is evidence (briefly referred to later in this paper) that some members of the Carboniferous flora of the Northern Hemisphere lingered on into the Permian in the Southern Hemisphere. Hence it is not impossible that the upper part of the Kuttung may be Upper Carboniferous. However, we do not consider this point vitally important. It has been suggested that if the Kuttung is Middle Carboniferous we must look for the Upper Carboniferous in the Lower Marine Series, but the break between the Kuttung and the succeeding Lochinvar shales is sufficient to account for the absence of the Upper Carboniferous. Those who put forward this argument have to face the facts (which we next discuss) that the fauna of the Lochinvar shales not only has practically no links with the Lower Carboniferous Marine Series (the Burindi), which underlies the Kuttung, but is closely allied with the Permian; in other words, that an Upper Carboniferous fauna has practically no survivals from the Lower Carboniferous, but continues almost unchanged into the Permian.

It is agreed by most contributors to this discussion that the beds from the base of the Greta upwards are Permian, and there is probably no one who would on the evidence now available seriously suggest that the base of the Permian should be placed higher than this. David and Sussmilch (3, pp. 497-499) place the base of the Permian tentatively at the base of a prominent *Eurydesma cordatum* horizon, 1,800 feet below the base of the Greta Coal Measures.

In support of this they rely on certain palaeontological criteria and on the following evidence. At Allandale the *Eurydesma* beds include a conglomerate which contains a number of andesite pebbles. There seems little doubt that these pebbles were derived from a Kuttung land mass now represented by the Blair Duguid inlier. These authors earlier stated that there exists a marked unconformity between the Allandale conglomerate and the Kuttung at Pokolbin. In the Cranky Corner Basin there is a condensed sequence of Lower Marine beds with no evidence of any break or even of conglomerate at the *Eurydesma* horizon.

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[2] The first appearance of this flora is about 2,000 feet above base of Lochinvar glacials.

[3] Walkom (3, p. 624) refers the Kuttung to the Lower Carboniferous, but the context indicates that he refers to a twofold division of the Carboniferous.

We consider that the evidence shows epeirogenic movement only, and not orogeny as has been suggested, and that the Pokolbin section represents an overlapping contact which has been tilted in later orogenies.

Since, then, the Lower Marine Series requires discussion, a section thereof, measured in the type area (5) and (3) is given:

Detailed Section of Lower Marine Series.

Stage.	Thickness in Feet.	Lithology.	Fossil Horizon.
Farley.	800–1,000	Sandy shales and mudstones.	9
	200	Mainly sandstones; Ravensfield sandstone at base.	8
Allandale.	560	Calcareous mudstone with thin beds of limestone. A few large granite erratics at top. Fossils about 130 feet above base. (=Pokolbin Ostracod horizon.)	7
	250	Allandale conglomerate with abundant *Eurydesma cordatum* overlain by Harpers Hill sandstone.	6
Lochinvar.	1,300	Shales and mudstones with a few erratics. Fossils abundant at top.	5
		Lowest horizon for *Gangamopteris* in Hunter Valley about half-way up in these beds.	4
	20	Limestone.	3
	310	Calcareous shale.	
	635	Amygdaloidal basalt.	
	345	Sandstone with indeterminable plant remains and marine fossils.	2
	150–250	Reddish-brown shales with glacial erratics. *Eurydesma hobartense* near the top.	1

The Lochinvar Stage would thus be put in the Upper Carboniferous by David and Sussmilch. We may therefore compare the fauna of this stage with that of the higher beds.

From horizon 2, Mr. W. S. Dun (4) recognized *Spirifer* aff. *tasmaniensis*?, *Dielasma* sp. indet., *Platychisma* sp., *Conularia* sp. (Dun thought this was not *Conularia levigata* Morris, but Fletcher is now satisfied that it should be referred to that species).

From 3, Dun identified the following fossils: *Fenestella internata*, *Fenestella fossula*, *Seminula* sp. nov., *Martiniopsis subradiata*, *Spirifer* aff. *tasmaniensis*, *Deltopecten limaeformis*, *Aviculopecten englehardti*, *Aviculopecten tenuicollis*, *Aviculopecten mitchelli*, *Chaenomya* sp., *Conocardium* sp. nov., *Orthoceras* sp.

From 4, Walkom records *Ptychomphalina trifilata*, *Ptychomphalina nuda*, and *Gangamopteris*, and from 5 the following (5):

Tribrachiocrinus sp.
Fenestella (?) *internata*.
„ (?) *fossula*.
Stenopora tasmaniensis.

Aviculopecten sp. nov.
„ *sprenti*.
„ *tenuicollis*.
„ *englehardti*.

Spirifer duodecimcostata.
„ *tasmaniensis.*
„ *vespertilio.*
„ *stokesi.*
„ *avicula.*
Martiniopsis subradiata.
var. *morrisii.*
cf. *morrisii.*
Productus cora var. *farleyensis.*
Strophalosia jukesi.
Chonetes sp.
Edmondia (?) *nobilissima.*
Merismopteria sp. nov.
Deltopecten subquinquelineatus.
„ *farleyensis.*
Myonia sp.
Pleurophorus.
Notomya (?).
Pachydomus.
Chaenomya.
Ptychomphalina trifilata.
Mourlonia rotundatum.
Platyschisma.
Keeneia (juv.).
Conularia levigata.
Plant stems.

On examining the list of fossils from horizons 1, 2, 3, 4, and 5 (i.e., from Lochinvar Stage), we find that of the forms recorded the only ones which are not found on horizons 6, 7, 8, and 9 are: *Tribrachiocrinus* sp., *Spirifer avicula, Strophalosia jukesi, Mourlonia rotundatum, Conocardium* sp. nov., *Seminula* sp. nov., *Ptychomphalina nuda, Dielasma* sp. indet. All of these except *Ptychomphalina nuda* and possibly *Seminula* sp. nov., are found in the still higher Upper Marine beds.

In fact, of the whole of the Lochinvar fauna as listed herein, only the following species are not known in the Upper Marine Series: *Productus cora* var. *farleyensis, Chonetes* sp., *Ptychomphalina nuda* and possibly *Seminula* sp. nov.

Discussing horizons 2 and 3, Dun (4, p. 204) stated: "A departure from a normal Permo-Carboniferous facies is afforded by the specimen probably referable to *Seminula.* A possible relationship to the Burindi (Lower Carboniferous) fauna is evidenced by this latter and by the *Spirifer,* which may be regarded as a distinctly transitional type." The identification of *Seminula* has since been questioned by Walkom (6, p. 625), and Miss Prendergast (7, p. 27) shows that *Seminula* is not uncommon in Permian beds.

It will be noted that *Eurydesma hobartense* is the lowest fossil recorded. Raggatt has long suspected that the criteria used for separating *Eurydesma cordatum* from *Eurydesma hobartense* were unreliable. It is to be noted that Etheridge (8, p. 75), in describing *Eurydesma hobartense,* stated: "The separation of this shell from *E. cordatum* is merely a question of degree—the general structure is the same, but all the parts are on a less massive scale." Both species occur in great numbers, and must have lived under similar conditions in the undisputed Permian beds of Maria Island, Tasmania. Morris and Dana recorded the genus from Upper Marine beds in the Illawarra District, while Frech recorded it from Kiama, also a locality in the Illawarra District (Upper Marine). Etheridge and Dun considered these localities to be probably due to errors in labelling, and were of the opinion that *Eurydesma* was a characteristic Lower Marine form. Since then specimens of both *Eurydesma hobartense* and *E. cordatum* have been collected from the Upper Marine at Ulladulla in the South Coast District of New South Wales.

The Pectinoid fauna of the Lower Marine and Upper Marine Series have many species common to both horizons. The facies of these shells are very similar, whereas in the Burindi an altogether different type of shell is found, smaller in size and with delicate ornamentation. Etheridge and Dun (9, p. 1) state: "The Aviculopectinidae of the Carboniferous System of New South Wales are rare, having been found in only a few localities. They are small, and are closely allied to European and American forms. On the other hand, one of the most striking features of the fauna of the Permo-Carboniferous Marine beds of New South Wales, and, in fact, of Eastern Australia, is the variety and large size of the Pectinoid shells, one very noticeable fact being the apparent isolation of types displayed by these genera."

John Mitchell, in 1924 (10, pp. 468–474), described eleven new species of *Aviculopecten* from newly discovered Carboniferous beds on the shores of Myall Lakes, New South Wales. The species are totally dissimilar to the Permian *Aviculopecten* fauna, and for close general comparisons Mitchell had to resort to European Carboniferous species.

Cowper Reed (11, pp. 72–73) states: ". . . . it has not been possible in Kashmir to distinguish between beds corresponding respectively to the Lower and Upper Marine beds of New South Wales." As geological work proceeds in New South Wales the differences between these faunas is seen to be less and less marked. The genus *Eurydesma* is an instance of this; another is *Aviculopecten mitchelli*, which was formerly thought to be a Lower Marine species, but has since been found in the Upper Marine at Ulladulla and Branxton. It is not possible at present to make a direct comparison of the faunas. Much information has been collected over the past decade by the Geological Survey of New South Wales during coal-field surveys, but most of this work is unpublished.

In 1929 Raggatt referred some fossils from the Muswellbrook District (Middle Hunter Valley) to the late W. S. Dun for identification. Dun supplied the following list of determinations:

Productus cf. *P. bellistriata.*
Spirifer cf. *acuta.*
„ *stokesi.*
„ *avicula.*
„ *tasmaniensis.*
Martiniopsis subradiata.
Dielasma sacculus (inflate var.).
„ sp. nov.
Conocardium sp. nov.
Pleurophorus sp. nov.
Eurydesma hobartense (?).
Platyschisma oculum.
Mourlonia subcancellata var.
Keeneia sp. nov.
Ptychomphalina sp.

At the time these fossils were collected their stratigraphical position was unknown. Dun commented that if they had come from the Lower Hunter he would have had no hesitation in referring them to the Lower Marine. But in subsequent field-work the Greta Seam was found eighty feet below the fossils, which therefore are in the Upper Marine. If Dun, with his intimate knowledge of these faunas, could not place a suite of fifteen species definitely in one series or the other, one is entitled to conclude that the faunal differences must be slight. The Upper Marine fauna is more diverse than that of the Lower, but the number of species restricted to the Lower Marine must be very few.

Thus it seems clear that a separation of the Lower Marine Series into Upper Carboniferous and Lower Permian has little palaeontological evidence to support it. As we have already stated, those who advocate such a division are in effect suggesting that an Upper Carboniferous fauna has practically no links with the Lower Carboniferous, but has strong affinities with the Permian.

Other Eastern Australian Sections.

In support of their tentative conclusion that the base of the Permian should be placed at the base of the *Eurydesma* beds of Allandale, and of the thesis that the *Glossopteris* flora ranges down to the Carboniferous, David and Sussmilch (3, pp. 502–514) discuss other Upper Palaeozoic sections in Australia. Those of Eastern Australia are briefly referred to here. These authors rely mainly on the presence of *Monilopora nicholsoni*, *Cladochonus tenuicollis*, and *Taeniothaerus subquadratus* as establishing a Carboniferous age. Bryan (12, pp. 71–74) has since shown the unreliability of *Monilopora nicholsoni* as an Upper Carboniferous zone fossil, and more evidence showing that this species ranges well up into the Permian has become available since Bryan's paper was published.

The value of *Monilopora nicholsoni* as an Upper Carboniferous zone fossil has also been discredited by the new evidence available from Western Australia. In each of the three marine Permian basins of Western Australia, *Monilopora nicholsoni* is rcorded from one horizon only. In the Irwin River Basin it is recorded from the Fossil Cliff beds, which are about 1,000 feet above the Ammonoid beds now known to be Permian (64). In the North-West Basin, *Monilopora nicholsoni* occurs in the Callytharra beds with a diverse Permian fauna which includes *Aulosteges*, a genus whose importance as indicating a Permian age is stressed by David. In the Kimberley Basin, *Monilopora nicholsoni* occurs no less than 2,000 feet above limestones containing Permian Ammonoids (13).

Voisey has recently given some particulars concerning the Drake Series (northern New South Wales (14, pp. 155–168), the age of which, as shown by his research, is Lower Permian. Of thirty-four forms listed by him (p. 164), twenty-seven are found in the Upper Marine Series of the Hunter Valley. *Eurydesma* has not been found here, but *Monilopora nicholsoni*, *Cladochonus tenuicollis* and *Taeniothaerus subquadratus* are all present, the corals being found in abundance at the top of the Series.

Voisey has also described the Macleay Series of the Kempsey District (North Coast District of New South Wales) (15, pp. 189–197). He considers that this series can be correlated with the Drake Series and the Lower Marine Series of the Hunter Valley. The Permian age of the Macleay Series is also beyond doubt; of twenty-two definitely determined species in Voisey's lists, twenty-one are found in the Upper Marine Series of the Hunter Valley. *Eurydesma cordatum* occurs here in abundance. *Monilopora nicholsoni* and *Cladochonus tenuicollis* also occur above, below, and in the same beds as *Eurydesma cordatum*, *Monilopora nicholsoni* being "most abundant" in a limestone above *Eurydesma cordatum*.

Taeniothaerus subquadratus occurs in the Lower Marine Series in the Hunter Valley (16, p. 301) and the Lower Bowen of Queensland, and ranges well up in the Western Australian section.

It is believed that specimens referred to *Monilopora nicholsoni* constitute several species and possibly more than one genus (12). When these have been described, it is possible that the range of one or the other of these species may be found to have value in correlation.

David and Sussmilch (3, pp. 502–503) also discuss the Springsure (Queensland) section of the "Permo-Carboniferous". This section was measured by J. H.

Reid (63, pp. 92–98, and 18, p. 57), and its implications are sufficiently important to warrant quoting it again:

	Thickness in Feet.
Upper Coal Measures	5,000
Middle Bowen Marine shell beds with glacial horizons	900
Lower Bowen Serecold Sandstone with *Conularia* sp. and *Gangamopteris* cf. *cyclopteroides* Feist.	950
Dilly Stage. Marine glacials and freshwater beds with *Eurydesma cordatum*, *Eurydesma* sp. nov. *Plerophyllum gregoriana* abundant. Fairly diverse marine fauna (see below)	375
Catherine Sandstone	500
Coral Stage (Marine) *Monilopora nicholsoni* and *Trachypora wilkinsoni* abundant. *Martiniopsis subradiata*, *Warthia micromphalus*	500
Aldebaran Sandstone with " Rare fragments of *Glossopteris* ".	2,500
Gypseous (Marine) Stage. This stage and upper part of next below have *Martiniopsis subradiata* (small form), *Deltopecten comptus*, *Productus brachythaerus*	350
Staircase Sandstone	950
	11,900

David and Sussmilch place the base of the Permian at about the base of the Catherine Sandstone, stating that the beds with *Monilopora nicholsoni* and *Trachypora wilkinsoni* mark the top of the Upper Carboniferous.

Reid gives reasons for regarding the Dilly Stage as Lower Permian, and, of the seventeen species he lists (18, p. 58) as being of "more than ordinary interest from the stage", thirteen are known from the Upper Marine and three from the Lower Marine of New South Wales.

He also says (p. 58): "The Lower Bowen section below the Dilly Stage is not well known, and it would be unsafe yet to dogmatize as to the downward range of some of the characteristic species of that stage, the base of which has not been definitely identified."

Frank Reeves, in an unpublished report to Oil Search Ltd., states: "The lowest known formation in the region is the Staircase Sandstone, which may underlie the Dilly by a few hundred feet. Reid places the Catherine Sandstone, Coral Stage, and Aldebaran Sandstone below the Dilly. We find these overlie the Dilly and are respectively the Consuelo Sandstone, Ingelara Stage, and the Serecold Sandstone. It is probable that Reid's Gypseous Stage is the lower part of the Dilly."

K. Washington Gray and I. C. H. Croll confirm Reeve's interpretation of the Springsure section, with perhaps one slight modification. All the foraminifera noted by Irene Crespin in their specimens from the Gypseous Stage are found in higher beds and are also recorded from the Upper Marine Series of New South Wales, but some specimens from low in the Dilly Stage contain foraminifera which were not noted from the Gypseous Stage or higher beds, and three of which are recorded from the Lower Marine Series of New South Wales. It is unlikely, therefore, that the Gypseous beds would represent only the lower part of the Dilly. Gray and Croll regard the "Gypseous beds" as a facies variant of the Dilly, and equate the sandstone which overlies them ("Aldebaran" Sandstone of Reid) with the Serecold Sandstone. (From unpublished report kindly made available by Dr. K. Washington Gray.)

The revised section of the Lower Bowen as worked out independently by F. Reeves and by K. Washington Gray and I. C. H. Croll is:

Descending Sequence.	Thickness in Feet.
Catherine or Consuelo Sandstone	275–500
Coral or Ingelara Stage	425–500
Serecold or Aldebaran Sandstone	1,700–3,000
Dilly or Gypseous Stage	350–625
Staircase Sandstone	950
	5,575[1]

[1] Maximum.

This section shows that the beds containing *Monilopora nicholsoni* in abundance occur above those with *Eurydesma.* This interpretation tends to be supported by the fact that Reid himself records *Monilopora nicholsoni* "in post-Dilly beds of the Springsure dome" (18, p. 64). It will be noted that the relative positions of the main horizons of *Eurydesma* and *Monilopora* in this section are the same as at Kempsey, and the reverse of what they were originally thought to be.

The Springsure evidence is entirely opposed to the interpretation placed upon it by David and Sussmilch that *Glossopteris* descends "probably into rocks of Upper Carboniferous age". A further point of interest is that *Productus brachythaerus,* stressed by these authors as a Permian species (3, p. 499), occurs at Springsure below *Eurydesma,* with *Deltopecten comptus* and *Martiniopsis subradiata.*

Similarly, there is no proof that the *Glossopteris* beds of the Rockhampton District are Upper Carboniferous. These occur in the Dinner Creek Series of the Lower Bowen. There is nothing in the published lists of the Lower Bowen fauna to suggest that it is any different from the New South Wales Permian (of this paper).

J. H. Reid, after a critical discussion of the Gympie Series, concluded (17, p. 60) that: "The Middle Gympie beds of the Gympie Goldfield are entirely older than the recognized Lower Bowen of the Great Syncline, the Dinner Creek *Glossopteris* beds and the Lower Marine of the Hunter River (New South Wales) . . . ."

Reid correlated the Neerkol beds with the Gympie, and this, no doubt, considerably influenced him in coming to the conclusion quoted above. As he himself pointed out, however, these beds contain only four species in common, and their relationship to the Lower Bowen is different. Reid states (17, p. 69): "Yet the present difficulty obtrudes itself of where to draw a division line between Gympie and Lower Bowen marine beds owing to their apparent general conformability, should a sequence be found." Concerning the relationship between the Neerkol and the Dinner Creek beds (Lower Bowen), he writes (17, p. 39): "The heavy boulder conglomerates form the base of the Dinner Creek Series, and, as they have been derived partly from the whitish grits of the Neerkol Series, a considerable break in sedimentation is evinced."

It has been suggested by F. W. Whitehouse (14, p. 163), that the Neerkol fauna is also represented at Mt. Barney in Queensland, and he and Voisey (14,

p. 163) consider that the Neerkol can be correlated with the Emu Creek Series of the Drake Area in New South Wales. If we accept these views we must conclude that the Neerkol is certainly older than the Drake Series, that is, than the Lower Marine Series of the Hunter Valley (New South Wales). This Neerkol fauna is as yet too poorly described to permit a detailed analysis, but it certainly contains Carboniferous species which are not found in higher beds, and is probably of Upper Carboniferous age.

We conclude that the Neerkol beds, therefore, are older than the Gympie, and that in discussing the age of the Gympie Series we should consider only the list of fossils from Gympie itself. This list comprises forty-eight species, of which thirty-four are found in the Lower Bowen or higher beds. Of the remainder, *Spirifer dubia* is found in the Callytharra Stage (Middle (?) Permian) of North-West Basin, Western Australia. *Leptaena analoga* is found in the Rockhampton Series of Queensland (Lower (?) Carboniferous) and the Burindi (Lower Carboniferous) of New South Wales, but is also recorded from the Callytharra Stage and the Agglomeratic Slate of Kashmir (Lower Permian). *Polypora* (?) *smithii* is a Neerkol species. The rest (eleven species) are local species, a number of the determinations being tentative.

It is considered that the "Middle Gympie" is of Permian age; that it probably is, as Reid contends, pre-Bowen, or, say, pre-Dilly Stage, but that it is not pre-Lower Marine (of New South Wales). In other words, that it can be correlated approximately with the Lochinvar Stage of the Hunter Valley. David (65) also came to this conclusion.

Gangamopteris is recorded from the Gympie Series (19, p. 38) from an horizon which may be fairly safely put down as coming from somewhere about the middle of the Gympie Succession. This horizon probably corresponds approximately to that of the lowest record for *Gangamopteris* in New South Wales.

India and Neighbouring Lands.

According to Fox (20, p. 9), the Lower Gondwana sequence in the Salt Range, Punjab, is:

Productus limestone (Upper, Middle, Lower).
Speckled Sandstone.
Glacial boulder bed (Blaini tillite).

The Productus limestone is the equivalent of the Damuda of India and the lower beds of the Talchir glacial series. The divisions of the Productus limestone are commonly regarded as being, respectively, Upper, Middle, and Lower Permian. The Ammonites from the Upper Productus limestone show that it is late Permian, and an examination of the Fusulinids leaves little doubt that the Lower Productus limestone is Permian (see Dunbar, 21, pp. 405–413).

Early in this discussion, Thomas (22, pp. 946–948) stated that he considered that the base of the Permian should be drawn above *Schwagerina*. Cowper Reed (23, pp. 36–37 and footnote) refers a fauna from Tibet with *Schwagerina* to the Upper Carboniferous, but remarks that *Schwagerina princeps* is believed to range up into the Permian. The tenor of recent papers (24 and references therein) indicates a general tendency to place the base of the Permian in Europe, Asia, and America at the base of the *Schwagerina-Uddenites* zone, that is, to include most, if not all, of the Uralian in the Permian.

Unfortunately, neither of these zone fossils occurs in the countries we are discussing, but the zone Fusulinids of the higher Permian occur in India. Because of the absence of *Schwagerina*, *Schuchert* (25, p. 547), also Dunbar (21) incline to the view that the Lower Productus limestone is in the upper part of the Lower Permian or somewhere in the Middle Permian. At least it is agreed that the Productus limestone is Permian.

The geologists of India have usually regarded the Speckled Sandstone and Talchir Series as Upper Carboniferous. It is to be noted, however, that beds formerly regarded as Upper Talchir (Karharbari Stage) are now included in the Lower Barakara (i.e., Permian), leaving only about 1,000 feet of Lower Gondwana strata classified as Upper Carboniferous (see Fox, 20, p. iv).

So far as can be judged from a study of the literature, the conclusion that the Speckled Sandstone, Lower Talchirs, and their correlates in Kashmir and neighbouring regions are Upper Carboniferous, is based mainly on a comparison of the faunas with that of the so-called "Carboniferous" of New South Wales.

Much of Thomas's argument (22, pp. 946–7) depends on the fact that the overlying strata are Lower Permian and on the Upper Carboniferous age of the *Eurydesma-Conularia* fauna. In view of the facts already presented in this paper, we are of opinion that this view is no longer tenable.

As long ago as 1893 Oldham (26, p. 121) wrote that the Speckled Sandstone contained "thirteen out of twenty-two species which are identical with forms found in the marine Carboniferous beds of New South Wales, showing not only contemporaneity, but free communication between the two areas".

This statement is based on Waagen's (27, pp. 144–147, 153–155) list of fossils from the Speckled Sandstone, which is as follows:

Lowest Horizon:
Hyolithes orientalis Waag.
„ sp. indet.
Cardiomorpha indica Waag.

Middle Horizon:
A *Pleurotomaria nuda* Dana.
Bucania warthi Waag.
A *Conularia laevigata* Morris.
A „ *tenuistriata* McCoy.
„ *warthi* Waagen.
A *Sanguinolites* cf. *mitchelli* De Kon.
A „ *tenisoni* De Kon.
Nucula sp. indet.
Pseudomonotis subradialis Waag.
A *Aviculopecten* cf. *limaeformis* Morris.
A *Spirifer vespertilio* Sow.
A „ *darwini* Morris.
A *Chonetes cracowensis* Eth.
Discina sp. indet.
Discinisca warthi Waag.
Serpulites undulatus Waag.
„ *warthi* Waag.
„ *tuba* Waag.

Highest Horizon:
A *Eurydesma globosum* Dana.
A „ *ellipticum* Dana.
A „ *cordatum* Morris.
A *Maeonia gracilis* Dana.

The thirteen species considered by Waagen to be identical with species occurring in Australia are marked A in the above list. The range of these species in Australia as now known is:

Pleurotomaria nuda Dana	Lower Marine, Hunter Valley, New South Wales.
Conularia laevigata Morris	Lower and Upper Marine Series.
„ *tenuistriata* McCoy	„ „ „ „ „
Sanguinolites cf. *mitchelli* De Kon.	Upper Marine Series.
„ *tenisoni* De Kon. ..	Burindi Series, New South Wales.
Aviculopecten limaeformis Morris	Lower and Upper Marine Series.
Spirifer vespertilio Sow.	Lower (?) and Upper Marine Series.
„ *darwini* Morris	Upper Marine Series.
Chonetes cracowensis Eth.	Rockhampton Series, Gympie Series and Lower Bowen Series, Queensland.
Eurydesma globosum Dana	Upper Marine Series.
„ *ellipticum* Dana	Lower Marine Series.
„ *cordatum* Morris	Lower and Upper Marine Series.
Maeonia gracilis Dana	Upper Marine Series.

In addition, it may be noted that another species, *Conularia warthi* Waagen, occurs over a range from about 1,500 feet below the top of the Lyons Series to the Byro Stage in Western Australia.

Thus, of fourteen species eleven are known from the Permian of Eastern Australia (nine of them ranging high in the system), and one from the Permian of Western Australia. *Chonetes cracowensis* Eth. ranges from Lower Carboniferous to Lower Permian, and one only, *Sanguinolites tenisoni* De Kon., is Carboniferous.

In a recent publication Cowper Reed (28) gives some further comments on a fauna from strata "approximately contemporaneous" with the *Eurydesma* beds described by Waagen. The fauna comprises thirty species, thirteen of which, according to him, are "identical, allied, or comparable" with Australian species. These species with their range in New South Wales are:

Fenestella fossula Lonsd.	Upper Marine Series.
Dielasma amygdala (Dana)	Upper Marine Series.
Pterinea lata De Kon.	(see footnote[4])
Tellinomya darwinii De Kon.	Lower Marine Series (High).
Cardiomorpha pusilla (McCoy) (= *Astartila pusilla*)	Upper Marine Series.
Meaonia gracilis Dana (= *Cleobis gracilis*)	Upper Marine Series.
Astartila ovalis (McCoy) (= *A. intrepida* Dana)	Upper Marine Series.
Pachydomus danai De Kon.	Upper Marine Series.

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[4] Cowper Reed compares this shell with *Pterinea lata* De Kon., rather than with *Merismopteria macroptera* (Morris). The specimen is an imperfect anterior portion, and it is difficult to determine exact characters. His figures (pl. v, figs. 6, a, b) place the shell in the genus *Merismopteria*, common in the Upper Marine Series. *Pterinea lata* De Kon. is a Burindi (Lower Carboniferous) form.

Eurydesma cordatum Morr.	Lower and Upper Marine Series.
„ *cordatum* var. *sacculum* Dana	Lower Marine Series.
„ *hobartense* Johns.	Lower and Upper Marine Series.
„ *ellipticum* Dana	Lower Marine Series.
„ *globosum* Dana	Upper Marine Series.

It will be noted that the fauna had a dominantly Permian aspect.

How strongly the age determinations of faunas in Southern Asia are based upon comparison with Australian (particularly Eastern Australian) faunas may be seen from Cowper Reed's recent discussion of fossils from Kashmir, which he concludes are Upper Carboniferous.

He writes: "In the Kashmir fauna . . . . we can recognize the presence of the following Australian species or varieties of them":

A *Protoretepora ampla* Lonsd.
A *Spiriferina duodecimcostata* (McCoy).
A *Spirifer* (*Brachythyris*) *darwini* (Morris).
W.A. „ (*Neospirifer*) *hardmani* Foord var.
W.A. „ („) *fasciger* Keys. var. *australis*.
A *Maeonia gracilis* Dana var.
A *Astartila transversa* Dana.
A *Eurydesma cordatum* Morr. vars.
A *Astartila ovalis* (McCoy).
A *Warthia micromphala* (Morris).

The forms marked "A" in the above list are found in the Upper Marine Series of New South Wales and are by no means uncommon forms. The remaining two marked "W.A." are found in the Callytharra and Wooramel Stages of the Western Australian Upper Palaeozoic sequence. Thus they are all found in the Permian of Australia. Further, according to Cowper Reed (11, p. 73): "Of other Kashmir species, which through poorness of the specimens and their imperfect preservation, or as a result of the inadequate description of the Australian types, cannot be positively identified with Australian forms, there are the following":

A *Stenopora* cf. *gracilis* Dana.
A „ cf. *crinita* Lonsd.
A *Fenestella* cf. *fossula* Lonsd.
A „ cf. *internata* Lonsd.
A *Strophalosia* cf. *clarkei* Eth.
A *Spirifer* (*Fusella*) cf. *avicula* Sow.
A *Martiniopsis* sp. (cf. *M. subradiata* Sow).
Orthis (*Rhipidomella*) sp. (cf. *O.* (*Rh.*) *australis* McCoy).
A *Sanguinolites* cf. *carinatus* (Morr.).
Parallelodon cf. *interrupta* De Kon.
A *Aviculopecten* cf. *mitchelli* Eth. & Dun.
A *Eurydesma* cf. *globosum* Dana.
A *Astartila* cf. *corpulenta* Dana.
L.M. *Pleurotomaria* cf. *nuda* Dana.

To these we may add:

A *Strophalosia* cf. *gerardi* (King).
A *Spiriferina* cf. *stokesi* De Kon.
A *Aviculopecten* (*Deltopecten*) cf. *subquinquelineatus* McCoy.

L.M. *Pachydomus* ? cf. *sacculus* McCoy.
Leptaena analoga (Phill.).
Spirifer hardmani Foord.

Nearly all the above species (those marked "A") have been collected from the Upper Marine Series; two, *Pleurotomaria* cf. *nuda* Dana, *Pachydomus* ? cf. *sacculus* McCoy, from the Lower Marine Series.

One species, *Orthis* (*Rhipidomella*) *australis* is a Burindi (Lower Carboniferous) form. *Leptaena analoga*, another Burindi form, is recorded from the Rockhampton Series and Gympie in Queensland, and the Callytharra Stage of North-West Basin, Western Australia. *Spirifer hardmani* ranges from the Lyons Series to the Wooramel Stage in Western Australia. That is, of the thirty forms listed, twenty-six are found in the Permian of Eastern Australia, and of the remainder all except one range up into the Permian in Western Australia.

In a later work Cowper Reed (28, p. 3) considers that differences between the faunas of the Agglomeratic Slate and the Talchir Series may probably be attributed to physical environment rather than to age. He is, however, inclined to place the Kashmir fauna slightly higher than the Salt Range, mainly because "the genus *Eurydesma* marks two distinct stratigraphical horizons in Australia and is represented on them by different species . . ." As we have seen, it is no longer possible to maintain that *Eurydesma cordatum* and *Eurydesma hobartense* mark two distinct stratigraphical horizons in Australia.

Summarizing, we may say that close correlation between the Upper Palaeozoic sequences of Southern Asia and Eastern Australia is possible; namely, glacials followed by the *Eurydesma* fauna, passing up into beds containing *Gangamopteris*-*Glossopteris* and an admittedly Permian marine fauna. Also that the faunas of the Speckled Sandstone Series and the Agglomeratic Slate of Kashmir, like that of the Lower Marine Series of New South Wales, have close affinities with the Permian Upper Marine and few with the Carboniferous. In regard to the last statement we may quote Cowper Reed, who writes (11, p. 77): ". . . but we must admit that the fauna of the calcareous facies of the Upper Carboniferous of Europe and Asia shows very few features in common with that of the Salt Range, Kashmir, and Australia."

We therefore conclude that the Speckled Sandstone Series, the Agglomeratic Slate and the Lower Marine Series of New South Wales are Lower Permian.

SOUTH AFRICA.

A sequence closely similar to that of India and New South Wales is found in South Africa. The Dwyka Series has glacials at or near the base (in some places resting on a glaciated surface) which pass upwards into shales, which have yielded *Eurydesma globosum*, *Conularia* sp., *Orthoceras* sp., and *Productus* (see Cowper Reed (11, p. 72) and Du Toit (29, p. 215)). These beds are overlain by the Ecca Series, characterized by the *Glossopteris* flora and regarded as Lower Permian (Du Toit, 29, p. 280).

Correlates of these beds in the Congo Basin have recently been described by Veatch (30, pp. 78–114).

The South African succession differs from that of Southern Asia and New South Wales in that *Gangamopteris* appears right at the base of the tillite and below *Eurydesma*. In New South Wales and Asia the order of appearance of these fossils, as we have seen, is reversed.

Du Toit (29) considers that all the beds below the Ecca Series are Upper Carboniferous. Veatch (30, p. 96) regards the correlate of the Upper Dwyka on the Congo with *Glossopteris* sp. and *Cyclodendron leslii* as Permian, but considers the Dwyka tillite itself to be Upper Carboniferous. If Veatch concedes that beds with these two fossil plants are Permian, it is difficult to see why he should not also regard the Dwyka as Permian. Similarly, Du Toit stresses the fact that the presence of *Lepidodendron australe* (29, p. 280) in the Dwyka supports an Upper Carboniferous age for it, but also says "the collective evidence points to the Ecca Series as being not younger than Lower Permian, the flora actually including such typically Carboniferous genera as *Lepidodendron*, *Bothrodendron* and *Sigillaria*". (See Du Toit, 31, p. 245, for complete list of fossil plants.)

If the Ecca with such fossil plants is Permian, it is difficult to see why the Dwyka, which besides *Lepidodendron* has *Phyllotheca*, *Gangamopteris*, and *Dadoxylon* (?), should not also be regarded as Permian. We may note that Walkom (61, p. 164) suggests that the identification of *Lepidodendron australe* might be reviewed, and Du Toit's statement (31, p. 245) that the specimen identified was a fragment.

We have endeavoured to show that all the evidence available in Australia points to the fact that *Gangamopteris* and *Glossopteris* made their first appearance in the Permian. This flora is unanimously accepted in India as Permian. This is clear from the general tenor of recent reports. See Fox (20, p. iv), Gee (32, p. 27), Reed, Cotter and Lahiri (33, p. 443).

Diener (34, p. 111) and Middlemiss (35, p. 6) agree that beds containing *Gangamopteris* must be referred to the Permian, a view which is strongly supported by Licharew (36, p. 131) in his recent discussion of the fauna of the Kolyma region in Russia.

In view of all this evidence it seems curious that Du Toit and others should stress the presence of the lingering remnants of the *Rhacopteris* flora rather than the appearance of the newer *Glossopteris* flora. We are thus led to reaffirm Walkom's statement of 1929 (32, p. 165): "It is not to be expected that the pre-existing flora would have been completely exterminated before the initiation of the *Glossopteris* flora, and therefore the presence of a few species of the earlier flora associated with the *Glossopteris* flora should not be given undue weight in the determination of the age of the beds in which they occur. The first marked appearance of a flora (or fauna) is much more important in determination of age than the presence of the last lingering representatives of an earlier one."

Dr. Wade's work in the Kimberley Basin of Western Australia shows that *Lepidodendron* and *Bothrodendron* both occur above the Nura-Nura limestone, the age of which is undoubtedly Permian. (Verbal information, and 13.)

Other local evidence upon which Du Toit relies is the fossil fish and crustacea. Du Toit's list (29, p. 215) of forms from the Dwyka Series is:

Fishes: *Palaeoniscus capensis*, *Acrolepis lotzi*, *Namaichthys schroederi*, *Rhadinichthys* (?), *Elonichthys* (?).

Crustacea: *Pygocephalus* sp., *Anthrapalaemon* sp.

The original description of these is not available to us, but there seems to be some anomalies in this evidence, to judge from the statement of Dighton Thomas (22, p. 947), who writes that the occurrence of *Palaeoniscus*, *Anthrapalaemon* and *Pygocephalus* "does not invalidate" an Upper Carboniferous age for the Dwyka.

In considering the genera of the fossil fish from the Dwyka Series it is to be noted that three of them, *Palaeoniscus*, *Acrolepis*, and *Elonichthys*, are also found in the Permian and even extend into the Triassic. *Namaichthys* is *apparently* a local genus, while *Rhadinichthys*, the occurrence of which in the Dwyka Series is doubtful, is the only true Carboniferous form.

Veatch does not rely on this evidence, but on Haughton's study of the Reptilia. Haughton (62, pp. 252–262) does not adduce direct evidence bearing on the absolute age of the Dwyka glacials; his conclusion that the Reptilia (chiefly *Mesosaurus*) indicate an Upper Carboniferous age is based on a theoretical consideration as to rate of development and migration and cannot be allowed undue weight in the determination of absolute age. In fact, it would appear that his conclusions cannot stand in view of the recently published information from South America (discussed later).

Apart from the local evidence, both Du Toit and Veatch rely to a considerable degree on evidence from New South Wales. Their viewpoints, however, are quite different. Du Toit relies on a correlation of the Dwyka Series with the Lower Marine Series. We agree that the invertebrate fauna, though comprising only four genera, suggests a correlation of the Dwyka Series with the Lower Marine Series of New South Wales, and the Speckled Sandstone Series of India, the age of which, for reasons already given, we regard as Lower Permian. The *Eurydesma* (*globosum*) is recorded from the Upper Marine (Permian) of New South Wales. Veatch (30, p. 155) regards the Lower Marine Series as Permian, and develops his argument thus:

> "Beds containing glacial boulders are found in Australia at several horizons in the Lower Marine Series and Upper Marine Series, both of Permian age, but these deposits, in contradistinction to the continental glaciation shown by the great succession of tillites, outwash gravels and varve shales of the Carboniferous ice sheets . . . . show only iceberg transported materials from glaciers, presumably a considerable distance to the south. . . . In view of this condition in Australia, it seems improbable that the continental ice sheets survived much farther north, in Africa, beyond the Upper Carboniferous."

Veatch rightly stresses the change in type of glacial deposits. Browne and Dun (4, pp. 200–202) earlier stressed the same fact and, in addition, showed that not only was the environment different, but that the lithology of the pebbles and boulders was also different, indicating derivation from a different source. The older tillites have granite, aplite and quartz porphyries, the younger, diorites, gabbros, porphyrites and andesites, so that it cannot be argued, as it possibly might have been, if the reverse had been true, that the change was due to the stripping of a granite bathylith. Veatch, however, and so also Schuchert (25, p. 546), overlook the fact that a great number of the erratics in the Branxton and Muree beds are quartzites with Devonian fossils which can be matched at the outcrop 100 miles S.W. from the Hunter Valley. As this area is approached the quartzite boulders in the marine deposits are so numerous, i.e., in tillites at Dunedoo, Marangaroo, and Little Hartley, that we must conclude there was land ice there well into the Permian and certainly long after the appearance of the *Eurydesma* fauna.

Hence Veatch cannot conclude either that the glaciation is entirely pre-*Eurydesma* or pre-Permian.

SOUTH AMERICA.

The evidence to be gleaned from the Upper Palaeozoic succession of South America is similar to that of South Africa.

In the Parana basin the lower part of the Gondwana sequence is classified as follows (37, p. 1728):

Lower Estrada Nova	Shale and grey sandstone.
Iraty	Shale and bituminous limestone.
Tubarao Series	Sandstones and grey shale.
Itarare	Tillites and glacial sediments.

The Itarare glacials have not yielded many fossils. Cowper Reed assigned the fauna to the Carboniferous (38, pp. 494–496), but Oppenheim (37, p. 1738) thinks it should be regarded as Permian. The Tubarao Series contains a flora which, according to Oppenheim (p. 1741), David White considered to be Permian. The lower beds contain: *Gangamopteris cyclopteroides*, *Gangamopteris obovata*, *Glossopteris browniana*, *Cordaites hislopi*, *Phyllotheca griesbachi*, *Lepidopholios aricinius*, *Sigillaria bradrii*, *Lepidodendron pedroanum*, *Pecopteris* spp. Several species of *Glossopteris* are found in the higher Tubarao beds.

Here, as in South Africa, representatives of the *Rhacopteris* flora occur with those of the *Glossopteris* flora, an association which has already been considered in our discussion of the South African sequence.

Mesosaurus tenuidens is found in the Iraty shales. These beds are about 300 feet thick and pass upwards through the Lower Estrada Nova (about 200 feet thick) into Triassic sediments. In view of this and the considerable thickness of beds below the Iraty characterized by the *Glossopteris* flora, it would seem almost impossible to maintain an age older than Permian for *Mesosaurus*.

NORTH-WEST BASIN, WESTERN AUSTRALIA.

The term North-West Basin is used to describe a part of North Western Australia lying west of the 116th east meridian and north of 27° south latitude. It includes most of the country drained by the Lyndon, Minilya, and Wooramel Rivers, and the lower course of the Gascoyne.

A detailed account of the stratigraphy of this region was given by Raggatt in a recent paper (1). An abridged account appeared shortly afterwards in the Bulletin of the American Association of Petroleum Geologists (39).

A summary of the stratigraphy of the Upper Palaeozoic and some brief notes thereon are now given:

SUMMARY OF UPPER PALAEOZOIC STRATIGRAPHY (DESCENDING SEQUENCE).

Series.	Stage.	Thickness in Feet.	
Gascoyne.	Wandagee.	1,250–1,450	Mainly shale with thin-bedded friable sandstone and sandy limestone.
	Kennedy.	400–700	Almost wholly sandstone, including dense blocky ferruginous, well bedded white micaceous and fine grained yellowish-brown types. Ferruginous marine fossil casts and concretions found in some places.
	Byro. Disconformity ?	2,300	Mainly marine argillaceous sandstone and sandy shales in upper half; thin bedded marine sandstones and sandy to carbonaceous shales in lower half (mainly marine but freshwater in part). Small glacial erratics in lower 300 feet.
	Wooramel.	130–280	Sandstone with some thin quartz pebble bands. Sparse marine fauna.
	Callytharra. Disconformity ?	85–400	Flaggy limestone and calcareous shaly mudstone. Rich marine fauna.
Lyons.		2,150–2,400	Upper 300 feet mainly shales with sandstones and fossiliferous limestones; remainder fine grained sandstone, glacial boulder beds and some shales. Glacial erratics up to 12 feet in length. Marine fossils in lower part 1,300 to 1,600 feet below top of series.

The total thickness of the Upper Palaeozoic on the Gascoyne River is about 6,750 feet, and on the Lyndon River 7,350 feet. The Upper Palaeozoic is overlain unconformably by the Cretaceous and rests unconformably on the Pre-Cambrian.

The Lyons Series is distinguished from the rest of the sequence by being dominantly glacial. The lowest fossils known in the section are those found by Raggatt near Windalia Outcamp on the Lyndon River in 1935. These and the fossils at higher horizons prove that the upper half of the Lyons was deposited in a marine environment, and there is nothing in the lithology of the lower beds to suggest that the conditions under which they accumulated were different.

The Callytharra limestone is also a most distinctive stratigraphical unit, and, were it not for the Winnemia section (1, pp. 147–149), which suggests repetition of Callytharra conditions in early Byro time, the Callytharra might have been constituted a separate series.

Rudd (verbal statement) thinks that Raggatt is in error in assigning the highest beds exposed on the Minilya River to a stratigraphical position above the Kennedy. He considers that these beds are high in the Byro, and Miss Crespin states that the evidence of the micro-fauna is not opposed to this conclusion. If Rudd's contention is correct, proof of the existence of the Wandagee Stage rests upon bore information. This is scarcely open to any other interpretation. As we are mainly concerned in this paper with the age of the Gascoyne Series as a whole, the point is not important at the moment.

PALAEONTOLOGY.

The following fossil lists include those in the earlier paper (1), revised and enlarged. An attempt has also been made to include as much of other previously published information as possible. The lists, as now given, include a number of determinations of fossils from the Wooramel District. Oil Search Ltd. kindly made available a map of this area by E. A. Rudd and T. W. H. Dee. By reference to this map it has been possible to assign many of the fossils in the published lists to stratigraphical units.

Chapman and Miss Crespin have been the most important contributors to the list of fossil determinations, but some have also been made by Fletcher and Miss Prendergast. Fletcher's descriptions will appear shortly in these RECORDS. Since the publication of Raggatt's paper (1), Miss Crespin has had an opportunity of examining type specimens in Perth, and she and Fletcher have checked most of the original determinations. The authority for the determination is given in the next section of the paper.

As we do not refer specifically to the Foraminifera and Ostracoda in our discussion, they are omitted from the present lists.

List of Fossils in Series and Stages.

Lyons Series.

(*a*) About 1,600 feet below top of Series.

Fenestella propinqua De Kon.
Crinoid ossicles cf. *Platycrinus.*
Conularia warthi Waagen.

(*b*) About 1,300 feet below top of Series.

Plerophyllum australe Hinde.
Chonetes pratti Davidson.
(?) *Orthis* (*Rhipidomella*) *australis* McCoy.
Productus sp. nov.

(*c*) Upper part of Series.

Aviculopecten tenuicollis Dana.
Reticularia lineata Martin.
Evactinopora dendroidea Hudleston.
Amplexus pustulosus Hudleston.
Plerophyllum australe Hinde.
Spirifer fasciger var. *australis* Davidson.
„ *hardmani* Foord.
„ *byroensis* Glauert.
Cleiothyris macleayana Eth.
Linoproductus tenuistriatus var. *foordi* Eth.
Productus semireticulatus Martin.
„ *undatus* Defrance.
Spiriferella australasica Eth.

Gascoyne Series.

Callytharra Stage.

Clisiophyllum talboti Hosking.
Plerophyllum australe Hinde.
„ *sulcatum* Hinde.
„ *gregoriana* De Kon.
Amplexus pustulosus Hudleston.
Evactinopora dendroidea Hudles.
„ *crucialis* Hudles.
Dybowskiella sp.
Glyptopora sp.
Coscinum australe Bretnall.
Trachypora sp.
Pachypora sp.
Monilopora nicholsoni Eth.
Fenestella spinulifera Moore.
„ *pectinis* Moore.
„ *horologia* Bret.
„ *affluensa* Bret.
„ *fossula* Lonsd.
Rhombopora tenuis Hinde.
„ *multigranulata* Bret.
„ *mammillata* Bret.
Acanthocladia sp.
Aetomocladia ambrosioides Bret.
Streblotrypa etheridgei Bret.
„ *marmionensis* Eth.
Pinnatopora trilineata var. *texana* Moore.
Protoretepora ampla Lonsd.
Sulcoretepora meridianus Eth.
Polypora cf. *biarmica* Keyser.
Philocrinus sp.
Rhipidocrinus sp.
Platycrinus sp.
Cf. *Cyathocrinus*.
Cf. *Hexacrinus*.
Spiriferella australasica Eth.
Cleiothyris macleayana Eth.
„ „ var. *baracoodensis* Eth.
Chonetes pratti Davidson.
Strophalosia sp. nov.
Seminula randsii.
„ *callytharrensis* Hosking.
Seminula globulina Phillips.
Derbyia cf. *bennetti*.
Reticularia lineata Martin.
Schellwienella sp.
Productus semireticulatus Martin.
„ *punctatus* Phillips.
„ *undatus* Defrance.
„ cf. *spiralis* Waagen.
„ cf. *indicus* Waagen.
Linoproductus cancriniformis Tschern.
„ *tenuistriatus* var. *foordi* Eth.
Spirifer hardmani Foord.
„ *rostalinus* var. *auritus* Hosking.
„ *fasciger* var. *australis* Foord.
„ *dubia* Eth.
Spiriferina cf. *duodecimcostata* (McCoy).
„ *cristata* Schloth.
„ *cristata* var. *decipiens* Hosking.
„ *papilionata* Hosking.
Spirifer cf. *convolutus* Phill.
Syringothyris exsuperans De Kon.
Martiniopsis sp.
Taeniothaerus subquadratus (Morris).
Aulosteges baracoodensis Eth.
„ *spinosus* Hosking.
Composita subtilita Hall.
Streptorhynchus plicatilis Hosking.
Nuculana sp.
Deltopecten subquinquelineatus (McCoy).
Dielasma hastata Sowerby.
„ *nobilis* Eth.
Leptaena analoga Phill.
Pustula senticosa Hosking.
„ *micracantha* Hosking.
Aviculopecten sprenti Johnston.
„ *tenuicollis* Dana.
Bellerephon costatus Sowerby var.
Pleurotomaria sp.
Conularia warthi Waagen.
Spirorbis ambiguus Fleming.

Wooramel Stage.

Protoretepora ampla Lonsdale.
Fenestella horologia Bret.
„ *fossula* Lonsdale.
Aetomacladia ambrosioides Bret.
Rhombopora multigranulata Bret.
Streblotrypa marmionensis Eth.

Strophalosia clarkei Eth.
Productus undatus Defrance.
„ *brachythaerus* Sow.
„ *semireticulatus* Mart.
Taeniothaerus subquadratus (Morris).
Cleiothyris macleayana Eth.
Dielasma trigonaspis Hosking.
Spirifer rostalinus var. *auritus* Hosking.
Spirifer hardmani Foord.
„ *convolutus* Phill.
„ *fasciger* var. *australis* Foord.
Cardiomorpha blatchfordi Hosking.
Palaearca cf. *costellata* McCoy.
Deltopecten subquinquelineatus (McCoy).
Aviculopecten sprenti Johnston.
„ *tenuicollis* Dana.

Byro Stage.

Plerophyllum australe Hinde.
Fenestella horologia Bret.
Polypora cf. *gigantea* W. & Pich.
Philocrinus sp.
Tribrachiocrinus sp.
Chonetes pratti Davidson.
„ *cracowensis* Eth.
Dielasma trigonaspis Hosking.
„ *cymbaeformis* Morris.
Strophalosia clarkei Eth.
„ sp. nov.
Productus semireticulatus Martin.
Aulosteges ingens Hosking.
Linoproductus tenuistriatus var. *foordi* Eth.
Linoproductus cancriniformis Tschern.
Taeniothaerus subquadratus Morris.
Cleiothyris macleayana Eth.
Orthotetes crenistria Phill.
Spirifer byroensis Glauert.
„ *convolutus* Phill.
„ *rostalinus* var. *auritus* Hosking.
„ *fasciger* var. *australis* Foord.
„ *marcoui* Waagen.
Deltopecten subquinquelineatus (McCoy).
Aviculopecten tenuicollis Dana.
Sanguinolites sp.
Cardiomorpha blatchfordi Hosk.
Stutchburia sp.
Myalina sp.
Bellerephon (*Warthia*) sp.
Ptychomphalina maitlandi Eth.
Conularia warthi Waagen.
Palaechlya gigas Eth. (?).

Kennedy Stage.

Chonetes pratti Davidson.
Strophalosia clarkei Eth.
Spirifer fasciger var. *australis* Foord.
Spirifer byroensis Glauert.
Aviculopecten tenuicollis Dana.
Cardiomorpha blatchfordi Hosking.

Wandagee Stage.

Stenopora sp.
Chonetes pratti Davidson.
Spirifer rostalinus var. *crassus* Hosking.
„ *marcoui* Waagen.
„ *byroensis* Glauert.
„ *fasciger* var. *australis* Foord.
Spirifer convolutus Phill.
Aulosteges ingens Hosking.
„ *baracoodensis* Eth.
Strophalosia sp. nov.
Taeniothaerus subquadratus (Morris).

List of Fossils, with Local and Foreign Ranges.

The following is a list of the fossil fauna so far recorded from the Upper Palaeozoic beds of North-West Basin. The stratigraphical distribution of each species in this sequence is given and reference made to the authors who have recorded the species. Any species which have come under notice as being found in the Upper Palaeozoic of the Irwin River and Kimberley Districts (both in Western Australia) are indicated, though this reference does not pretend to be complete.

The range of the species found in Eurasiatic and Eastern Australian areas is given, the principal beds referred to being:

Lower and Upper Marine Series, New South Wales	Permian.
Macleay and Drake Series, New South Wales	Permian.
Burindi Series, New South Wales	Lower Carboniferous.
Bowen Series, Queensland	Permian.
Gympie Series, Queensland	Lower Permian.
Rockhampton Series, Queensland	Lower (?) Carboniferous.
Productus limestone, Salt Range, India	Middle and Upper Permian.
Speckled Sandstone, Salt Range, India	Lower Permian.
Agglomeratic Slate, Kashmir	Lower Permian.

These beds have all been discussed in the preceding pages.

Coelenterata.

1.	*Clisiophyllum talboti* Hosking	Restricted to Callytharra Stage (40).
2.	*Amplexus pustulosus* Hudleston	Lyons to Callytharra Stage (41), (42), (43).
3.	*Plerophyllum australe* Hinde	Lyons, Callytharra and Byro Stage (44), (40), (42), (45). Kimberley District (46). Irwin River District (42).
4.	„ *sulcatum* Hinde	Callytharra Stage (44). Irwin River District (42).
5.	„ *gregoriana* De Kon.	Callytharra Stage (44). Upper Marine Series. Burindi (?). Gympie to Middle Bowen Series.
6.	*Evactinopora dendroidea* (Hudl.)	Lyons and Callytharra Stage (45), (44), (41).
7.	„ *crucialis* (Hudl.)	Callytharra Stage (41). Kimberley District (46).
8.	*Dybowskiella* sp.	Callytharra and basal Byro Beds (44). This genus occurs in the Middle and Upper Divisions of the Productus Limestone.
9.	*Monilopora nicholsoni* Eth.	Callytharra Stage (44). Kimberley District (46). Gympie and Lower Bowen Series. Macleay and Drake Series.

Echinodermata.

10.	*Philocrinus* sp.	Callytharra and Byro Stage (44). Upper Marine Series. Middle Productus Limestone. Permian of Timor.
11.	*Rhipidocrinus* sp.	Callytharra Stage (44).
12.	*Platycrinus* sp.	Cf. *Platycrinus* from Lyons Stage. Callytharra Stage (44). Burindi. Lower Bowen (*Platycrinus* ? *nux* Eth.). Permian of Timor.

13. *Tribrachiocrinus* sp.	Byro Stage (44). Upper Marine Series. Lower and Middle Bowen Series. Macleay Series.
14. Cf. *Cyathocrinus*	Callytharra Stage (44), (41). Genus occurs in Permian of Timor.
15. Cf. *Hexacrinus*	Callytharra Stage (44).
16. *Poteriocrinus* sp.	Callytharra Stage (41). Permian of Timor.
Annelida.	
17. *Spirorbis ambiguus* Fleming	Callytharra Stage (43).
Bryozoa.	
18. *Fenestella propinqua* De Kon.	Lyons Stage (43). Macleay Series. Burindi. Upper Marine Series.
19. „ *horologia* Bretnall	Callytharra, Wooramel and Byro Stage (40), (47), (48).
20. „ *pectinis* Moore	Callytharra Stage (44).
21. „ *spinulifera* Moore	Callytharra Stage (44).
22. „ *affluensa* Bretnall	Callytharra Stage (47), (40).
23. „ *fossula* Lonsdale	Calytharra and Wooramel Stage (40). Upper Marine Series. Gympie to Middle Bowen Series. Agglomeratic Slate, Kashmir. Burindi.
24. „ *modesta* Ulrich	Callytharra Stage (44).
25 *Stenopora tasmaniensis* Lonsd.	Callytharra Stage (44). Lower and Upper Marine Series. Genus occurs in Gympie to Upper Bowen Series.
26. *Protoretepora ampla* Lonsdale	Callytharra to Wooramel Stage (44), (45). Lower and Upper Marine Series. Drake and Macleay Series. Gympie to Middle Bowen Series. Agglomeratic Slate, Kashmir.
27. *Polypora* cf. *biarmica* Keyser	Callytharra Stage (45). Upper Marine Series. Upper Productus Limestone.
28. „ cf. *gigantea* W. & P.	Restricted to Byro Stage (45). Middle Productus Limestone.
29. *Pinnatopora trilineata* var. *texana* Moore	Callytharra Stage (44).
30. *Glyptopora* sp.	Callytharra Stage (44).
31. *Sulcoretepora meridianus* Eth.	Callytharra Stage (47), (40).
32. *Coscinum* (?) *australe* Bret.	Callytharra Stage (44), (47). (?) *Coscinum* from Wooramel Stage (40).

33. *Rhombopora tenuis* Hinde	Callytharra Stage (47), (44), (42).
34. „ *multigranulata* Bret.	Callytharra to Wooramel Stage (44), (40), (47).
35. „ *mammillata* Bret. ..	Callytharra Stage (40), (47).
36. *Aetomacladia ambrosioides* Bret.	Callytharra to Wooramel Stage (47), (44), (40)).
37. *Streblotrypa marmionensis* Eth. ..	Callytharra to Wooramel Stage (47), (44), (40).
38. „ *etheridgei* Bret.	Callytharra Stage (47)), (44).
39. *Acanthocladia* sp.	Callytharra Stage (44). Genus ranges from Burindi to Middle Productus Limestone.
40. *Lyropora* (?) *erksoides* Eth.	Callytharra Stage (47).
41. *Trachypora* sp.	Callytharra Stage (44). Upper Marine Series. Gympie and Lower Bowen (genus). Macleay Series and Drake Series.
42. Cf. *Pachypora*	Callytharra Stage (44). Gympie Series (genus). Permian of Japan (genus).

Brachiopoda.

43. *Leptaena analoga* (Phill.)	Callytharra Stage (44). Burindi. Rockhampton and Gympie Series. Agglomeratic Slate, Kashmir.
44. *Dielasma hastata* Sowerby	Callytharra Stage (44). Burindi to Upper Marine Series. Lower and Middle Bowen Series.
45. „ *cymbaeformis* Morr. ...	Byro Stage (40). Lower and Middle Bowen Series. Upper Marine Series.
46. „ *trigonopsis* Hosking ...	Wooramel to Byro Stage (49).
47. *Schellwienella* sp.	Callytharra Stage (44). Agglomeratic Slate, Kashmir.
48. *Orthotetes crenistria* (Phill.)	Byro Stage (43). Kimberley District (46). Irwin River District (50). Burindi. Genus only from Gympie, Lower and Middle Bowen Series.
49. *Chonetes pratti* Davidson	Lyons Series, Byro, Kennedy and Wandagee Stages (51), (44), (45), (40), (43), (48), (52), Kimberley District (46).
50. „ *cracowensis* Eth.	Byro Stage (44). Rockhampton to Lower Bowen. Speckled Sandstone.

51. *Strophalosia clarkei* Eth.	Wooramel to Wandagee Stage (45), (44), (48). Burindi (?). Upper Marine Series. Agglomeratic Slate, Kashmir. Gympie (?), Lower and Middle Bowen Series. Lower and Middle Productus Limestone.
52. „ sp. nov.	Byro Stage (45). Kimberley District (53).
53. *Aulosteges baracoodensis* Eth. ...	Callytharra, Byro and Wandagee Stage (54), (43), (48). Kimberley District.
54. „ *spinosus* Hosking	Callytharra Stage (54).
55. „ *ingens* Hosking	Byro and Wandagee Stages (45), (40).
56. *Taeniothaerus subquadratus* (Morris)	Callytharra to Byro Stage (44), (40), (55). Irwin River District (56). Kimberley District (57). Lower and Middle Bowen Series. Lower and Upper Marine (Tasmania). Lower Marine Series (N.S.W.).
57. *Productus semireticulatus* (Martin)	Lyons Series to Byro Stage (44), (40), (45), (48). Kimberley District (57). Burindi and Gympie Series. Lower Productus Limestone. Permian of Timor. Muscovian to Artinskian.
58. *Productus* sp. nov.	Lyons Series (45).
59. „ *punctatus* Phill.	Callytharra Stage (44). Burindi. Upper Carboniferous to Artinskian of Europe.
60. „ *undatus* Defrance	Lyons to Wooramel Stage (44), (40). Irwin River District (56), (50), (58). Burindi. Gympie Series (?).
61. „ cf. *indicus* Waagen ...	Callytharra Stage (45). Middle and Upper Productus Limestone.
62. „ cf. *spiralis* Waagen ...	Callytharra Stage (45). Lower Productus Limestone.
63. „ *brachythaerus* Sow. ...	Wooramel Stage only (44). Kimberley District (57). Gympie, Lower, Middle and Upper Bowen Series. Lower and Upper Marine Series.

64. *Linoproductus tenuistriatus* de Vern. var. *foordi* Eth.	Lyons Series, Callytharra and Byro Stage (44), (45), (40), (48). Kimberley District (57).
65. *Linoproductus cancriniformis* Tschern.	Callytharra and Byro Stage (55). Kimberley District. Artinskian.
66. (?) *Orthis* (*Rhipidomella*) *australis* (McCoy)	Lyons Stage only. Identification of imperfect single specimen (45). Known from Burindi and a shell with close affinities recorded from Agglomeratic Slate, Kashmir.
67. *Spiriferella australasica* Eth.	Lyons to Callytharra Stage (55), (44), (40). Irwin River District (56). Kimberley District (46).
68. *Spiriferina* cf. *duodecimcostata* (McCoy)	Callytharra Stage (44). The typical species is found in Burindi to Upper Marine. Gympie to Upper Bowen Series. Agglomeratic Slate, Kashmir.
69. *Spirifer fasciger* Keys. var. *australis* Foord	Lyons to Wandagee Stage (45), (52), (50), (43), (44), (40), (55). Agglomeratic Slate, Kashmir. Lower, Middle and Upper Productus Limestone. Permian of Timor. Kolyma area, Russia (Permian).
70. *Spirifer hardmani* Foord	Lyons to Wooramel Stage (45), (50), (40), (44), (43). Kimberley District (57). Agglomeratic Slate, Kashmir.
71. „ *byroensis* Glauert	Lyons, Callytharra, Byro, Kennedy and Wandagee Stage (44), (40), (52), (48), (46). Kimberley District (46). Lower Bowen (?).
72. „ *dubia* Eth.	Callytharra Stage (44). Gympie Series.
73. „ *convolutus* (Phill.)	Wooramel, Byro and Wandagee Stage (52), (44). Middle Bowen Series.
74. „ *rostalinus* var. *auritus* Hosking	Callytharra to Byro Stage (40).

75. *Spirifer marcoui* Waagen	Byro and Wandagee Stage (46), (45). Kimberley District (?) (57). Upper Speckled Sandstone. Lower and Middle Productus Limestone beds.
76. „ *rostalinus* var. *crassus* Hosk.	Wandagee Stage (40).
77. *Spiriferina cristata* Schloth. var. *decipiens* Hosking	Wooramel Stage (49).
78. *Spiriferina cristata* Schloth.	Wooramel and Byro Stage (49), (48). Lower and Upper Productus Limestone.
79. *Reticularia lineata* Martin	Lyons, Callytharra and genus recorded from basal Byro Stage (44), (55), (45), (40), (43). Irwin River District (50), (58). Burindi. Lower Productus Limestone. Permian of Timor. Moscovian to Artinskian. Fusulina limestone of Kinsyozan, Akasaka-Mati, Japan (Lower Permian).
80. *Cleiothyris macleayana* Eth.	Lyons to Byro Stage (44), (48), (43), (40), (50). Kimberley District.
81. „ *macleayana* Eth. var. *baracoodensis* Eth.	Callytharra Stage (43).
82. *Derbyia* cf. *bennetti*	Callytharra Stage (44).
83. *Syringothyris exsuperans* De Kon.	Callytharra Stage (44), (45), (50). Burindi. Genus recorded from Macleay Series. An allied species recorded from Agglomeratic Slate of Kashmir.
84. *Seminula randsii*	Callytharra Stage (44).
85. „ *globulina* Phillips	Callytharra Stage (55). Upper Productus Limestone.
86. „ *callytharrensis* Hosk. ..	Wooramel Stage (49).
87. *Martiniopsis* sp.	Callytharra Stage (44). Lower and Upper Marine Series. Gympie to Middle Bowen Series. Agglomeratic Slate, Kashmir (*M.* cf. *subradiata*). Lower and Upper Productus Limestone.
88. *Composita subtilata* (Hall)	Callytharra Stage (55). Irwin River District (58). Kimberley District (55). Burindi.
89. *Pustula senticosa* Hosking	Calytharra Stage (49), (48).
90. „ *micracantha* Hosking ...	Callytharra Stage (49).

91. *Streptorhynchus plicatilis* Hosking	Callytharra Stage (59).
92. *Spiriferina papilionata* Hosking	Callytharra Stage (49).

Pelecypoda.

93. *Palaearca* cf. *costellata* McCoy	Wooramel Stage (44). Burindi. Neerkol Series.
94. *Parallelodon* sp.	Callytharra Stage (40). Genus occurs in Rockhampton Series. „ „ „ Burindi Series. Agglomeratic Slate, Kashmir.
95. *Sanguinolites* sp.	Byro Stage (44). Burindi. Lower and Upper Marine Series. Gympie Series. Agglomeratic Slate, Kashmir.
96. *Nuculana* sp.	Callytharra Stage (44). Gympie to Lower Bowen Series. Agglomeratic Slate, Kashmir. (This form, *N.* (*Leda*) *thompsoni*, thought to be identical with form from Lower and Upper Marine Series. Kimberley District. Upper Productus Limestone.
97. *Cardiomorpha blatchfordi* Hosking	Wooramel to Kennedy Stage (40), (44).
98. *Aviculopecten tenuicollis* Dana	Lyons to Kennedy Stage (45), (44), (43). Kimberley District (53). Lower and Upper Marine Series. Lower and Middle Bowen Series.
99. „ *sprenti* Johnst.	Wooramel and Byro Stage (44), (52). Irwin River District (58). Lower and Upper Marine Series. Gympie and Middle Bowen Series.
100. *Deltopecten subquinquelineatus* (McCoy)	Wooramel and Byro Stage (40), (44), (48), (52). Irwin River District (56). Kimberley District (57). Lower and Upper Marine Series. Gympie, Lower and Middle Bowen Series. (?) Agglomeratic Slate, Kashmir.
101. *Deltopecten illawarensis* Morris	Wooramel Stage (49). Lower and Upper Marine Series. Lower Bowen Series.
102. *Stutchburia* sp.	Byro Stage (49). Irwin River District (58). Lower and Upper Marine Series. Lower and Middle Bowen Series.

Gastropoda.	
103. *Ptychomphalina maitlandi* Eth. ..	Callytharra and Byro Stage (44), (40).
104. *Pleurotomaria* sp.	Callytharra Stage (48). Lower and Upper Marine Series. Burindi. Gympie to Middle Bowen Series. Middle and Upper Productus Limestone beds. Agglomeratic Slate, Kashmir.
105. *Bellerephon* (*Warthia*) *costatus* Sowerb. var.	The genus has been recorded from Callytharra and Byro Stages (46). Irwin River District (58). Lower and Upper Marine Series. Lower to Upper Bowen Series. Upper Productus Limestone. Agglomeratic Slate, Kashmir.
Pteropoda.	
106. *Conularia warthi* Waagen	Lyons to Byro Stage (45), (40), (49), (52). Speckled Sandstone.
Cephalopoda.	
107. *Orthoceras* cf. *martinianum* De Kon.	Callytharra Stage (44). Burindi.

FAUNISTIC RESULTS AND CONCLUSIONS.[5]

The fauna of the Upper Palaeozoic beds of North-West Basin shows an intermingling of Eastern Australian and Productus Limestone forms with local species.

There are 107 species in the foregoing list. Two of these—14 and 42— have no importance in this discussion. Forty-four are local species, but these include three species of *Aulosteges*, a genus restricted to the Permian.

Of the remainder, 26 are identical with species described from the Permian of New South Wales. Actually 24 of these are found in the Upper Marine Series, only two—9 and 103—being restricted to the Lower Marine or an equivalent series. Eighteen species are known from the Productus Limestone, and, of these, six are found also in the Permian of New South Wales. Three species are recorded —106, 50, 75—which occur in the Speckled Sandstone, one of which—75—is also a Productus Limestone species, and one—50—a Rockhampton to Lower Bowen species. In addition to those already mentioned, seven species—12, 16, 65, 71 (?), 73, 72—have been recorded from the Permian of Timor, Europe or Queensland. Two forms—47, 70—are common only to Western Australia and the Agglomeratic Slate of Kashmir, and an additional three—43, 66, 95—common to Western Australia, Agglomeratic Slate and Burindi Series of New South Wales. That is, of 61 species common to both the North-West Basin and other regions, 51 occur in beds the Permian age of which has been indicated in this paper. The great majority, in fact, occur in beds whose Permian age has been accepted for many years.

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[5] Numbers quoted in this section of the paper refer to the foregoing list.

The nine species not so far considered are:

20. *Fenestella pectinis* Moore.
21. „ *spinulifera* Moore.
29. *Pinnatopora trilineata* var. *texana* Moore.
48. *Orthotetes crenistria* (Phill.)
60. *Productus undatus* Defrance.
83. *Syringothyris exsuperans* De Kon.
88. *Composita subtilata* (Hall).
93. *Palaearca* cf. *costellata* McCoy.
107. *Orthoceras* cf. *martinianum* De Kon.

The three American species—20, 21, 29—are recorded from the Upper Graham formation of North Central Texas, originally placed in the Pennsylvanian, but now, we understand, considered to be Lower Permian.

The remaining six are all Australian species and, with the possible exception of 60, are restricted to the Carboniferous in Eastern Australia. Two of these —48 and 60—range high in the Western Australian sequence, and it is worthy of note that these two, together with 88, have been recorded from other parts of Western Australia. Five of the six species are restricted to the Callytharra Stage.

Evidence bearing on the age of the North-West sequence is provided by correlation with the Irwin River and Kimberley areas. Some discussion of a suggested correlation with the Irwin River sequence has been given by Raggatt (1). One of the correlations discussed in that paper was that of the Callytharra with the Fossil Cliff beds. In preparing the present paper it has been noted that the beds contain many species in common. Miss Crespin agrees that the correlation is supported by a study of the Foraminifera (written note).

From shales about 500 feet above the glacials (equivalents of Lyons Series) in the Irwin River, ammonites have been collected which have been determined by A. K. Miller (60) as *Metalegoceras jacksoni*, a genus not known outside the Permian in Europe. This horizon is 1,000 feet below the Fossil Cliff beds.

One of the most important Upper Palaeozoic sequences in Australia is that of the Kimberley region, but until the results of Dr. Wade's recent researches have been published it would be unwise to attempt much discussion about this interesting region. It will be noted, however, that sixteen species in our lists are reported from the Kimberley area. It seems likely that the Callytharra fauna is represented in beds at Mt. Marmion. Ammonites lately collected by Dr. Wade from the top of the glacial series in the Kimberley succession have recently been described by A. K. Miller (13) as *Thallassoceras wadei* and *Metalegoceras clarkei*. He states: ". .... . it is concluded that the beds from which these cephalopods came are Middle Permian in age and are to be correlated in a general way with the *Metalegoceras jacksoni* beds of the Irwin River coalfield (Western Australia), the Bitauni beds of Timor, the Artinsk sandstone of the Urals and the Leonard formation of western Texas."

Whilst, therefore, it is concluded from the faunal analysis and the general evidence afforded by correlation that the whole of the Upper Palaeozoic succession of the North-West Basin is undoubtedly Permian, it is difficult to see where the dividing lines between Lower, Middle, and Upper Permian should be placed.

In the Lyons Series three species have been recorded from 1,600 feet below the top of the Series. *Fenestella propinqua*, which is apparently restricted to these beds in Western Australia, has been recorded from the Permian (Upper Marine and Macleay Series) of New South Wales. Ossicles of a crinoid doubtfully determined as *Platycrinus* have no value for stratigraphic correlation. The genus is found, however, in the Callytharra Stage and has been recorded from the Permian beds of Timor. *Conularia warthi* ranges into the Byro Stage. This species has been described from the Speckled Sandstones of the Salt Range, a series discussed in this paper and concluded to be Lower Permian.

From the middle horizon in the series, four forms have been collected. A new species of *Productus*, which is abundant here, does not appear to range any higher. *Plerophyllum australe* is also particularly abundant, but, like another fossil of this horizon, *Chonetes pratti*, it ranges well up in the sequence. It will be noticed that this is true of a great number of species in the North-West Basin. The fourth fossil is one referred to (?) *Orthis* (*Rhipidomella*) *australis*. This determination is doubtful, being based on a single badly preserved specimen.

Of the thirteen species so far recorded from the upper part of the Lyons Series, not one is restricted in range. Eight are local species, but included among them is *Evactinopora dendroidea*. In the Salt Range this genus is found only in the Middle and Upper Productus Limestone. Of the remainder, *Aviculopecten tenuicollis* occurs in the Lower and Upper Marine Series in New South Wales and the Lower and Middle Bowen in Queensland. Two particularly interesting species (*Reticularia lineata* and *Productus semireticulatus*), occur here. These are cosmopolitan species with about the same range, namely, Carboniferous to Artinskian. With them is *Spirifer hardmani*, also recorded from the Agglomeratic Slate of Kashmir. All these are found at higher horizons in the local sequence. The Carboniferous species, *Productus undatus*, previously referred to, occurs here, and ranges up to the Wooramel Sandstone.

In the Callytharra Stage are found several of the Carboniferous species—60, 83, 88—referred to above, along with a typically Permian assemblage, including *Deltopecten*, *Aulosteges*, *Nuculana*, *Strophalosia*, *Dybowskiella*, *Martiniopsis*, *Philocrinus*, *Protoretepora*, all the species discussed in the previous paragraph, and many others. The much discussed *Monilopora nicholsoni* and a common associate of this fossil, *Taeniothaerus subquadratus*, are also present, but, whereas the former is restricted to the Callytharra, the latter ranges up into the Byro. *Trachypora* sp. is a form in which the genus is common in the Upper Marine, *Trachypora wilkinsoni* being one of the most characteristic corals of that series. *Seminula globulina* has been recorded from the Upper Productus Limestone beds.

The presence of three Carboniferous species and of *Parallelodon*, *Schellwienella*, and *Leptaena analoga* in the Callytharra Stage suggests that it is low in the Permian.

Although there are perhaps 4,000 feet of strata above the Callytharra, the fauna does not show much variation.

The following species make their first appearance in the Wooramel Sandstone:

51. *Strophalosia clarkei.*
63. *Productus brachythaerus.*
74. *Spirifer convolutus.*
100. *Aviculopecten sprenti.*
101. *Deltopecten subquinquelineatus.*
102. „ *illawarensis.*

All except two—63, 102—are found in higher beds. These are all characteristically Permian forms, but all except one have a long range in Eastern Australia. The exception—74—is a Middle Bowen form.

Among species which first appear in the Byro those of special interest are: *Tribrachiocrinus* which occurs with abundant *Deltopecten subquinquelineatus, Dielasma cymbaeformis, Spirifer marcoui, Chonetes cracowensis* (Lower Permian in Queensland and India), *Orthotetes crenistria* (Burindi). *Spirifer marcoui* is found in Lower and Middle Productus beds, Middle Permian of India.

It is interesting to note also that *Spirifer fasciger* var. *australis* ranges from the top of the Lyons Series to the Wandagee beds. A closely allied, if not identical, species from the Salt Range extends from the Lower to the Upper Productus Limestones.

Mention may be made of the fossil shark *Helicoprion* (?). Great stress has been laid upon the importance of this fossil (2 and 3), but the facts about it unfortunately are that it was not found *in situ*, and that it is practically impossible to identify it beyond doubt. Judging by the lithology of the matrix and the fact that the specimen was picked up somewhere on the Arthur River, Raggatt would hazard the guess that it came from the Byro Stage. If so, it is Permian; but in view of the uncertainty attaching to the specimen no useful conclusions can be drawn from it.

From this analysis and from the evidence provided by correlations, we conclude that the greater part of the Lyons Series, including all the marked glacial boulder beds, is Lower Permian in age. As we have seen, the correlates of the upper part of the Lyons Series in the Irwin and Kimberley Districts contain ammonites considered to be Middle Permian. The upper shaly part of the Lyons Series, the Callytharra and Wooramel Stages, and the basal Byro beds of the Winnemia sequence (1, pp. 147–9), are all closely related palaeontologically, and should perhaps be grouped together in the Middle Permian. The remainder of the sequence is then Upper Permian.

Tentatively we suggest the following scheme of sub-division:

Upper Permian:	Wandagee, Kennedy and Byro Stages, except basal part.
Middle Permian:	Basal part of Byro Stage, Wooramel Stage, Callytharra Stage, upper 300 feet of Lyons Series.
Lower Permian:	Lower part of Lyons Series, including all important glacial beds.

Finally, some points of general interest may be mentioned.

The extended range of many of the species in the Permian of the North-West Basin has been remarked earlier. This is a feature common to the Permian of New South Wales, and has been emphasized by Reid (17, p. 47) in his discussion of the Queensland Upper Palaeozoic.

Small glacial erratics occur in the lower part of the Byro Stage in beds which are correlated with the "Upper Marine" of the Irwin River (1, p. 153). David (3) has suggested the correlation of the Irwin River coal measures with the Greta of New South Wales. This seems likely to be sustained, as does correlation of the Lyons with the Lochinvar glacials. The higher glacials would thus accord quite well with those of the Branxton-Mulbring beds of New South Wales.

Correlation with the Irwin River also provides valuable information on the appearance of the *Glossopteris* flora in Western Australia. With the exception of *Dadoxylon* (?) from an horizon high in the Byro, no determinable plant fossils have been found in the North-West Basin. However, from the Irwin River coal measures, which are considered to be the equivalents of the basal Byro beds, the following plants have been identified (3, p. 509): *Gangamopteris*, three species of *Glossopteris*, *Noeggerathiopsis*, *Bothrodendron*, *Sphenopteris lobifolia*.

In the palaeozoic fauna of the North-West Basin we clearly have many representatives of the typical cold-water (*Eurydesma-Conularia*) Permian fauna, though *Eurydesma* itself, curiously enough, has not been found there so far. The similarity in the faunas of the Kashmir, Indian, and Australian sequences is so striking that contemporaneity and free communication between these regions may be assumed. We appear to be justified in concluding that beds characterized by the *Eurydesma-conularia* fauna and the *Gangamopteris-Glossopteris* flora should be assigned to the Permian.

ACKNOWLEDGMENTS.

It is with pleasure we acknowledge our indebtedness to Dr. Arthur Wade and to Dr. K. Washington Gray, who have so generously placed the results of their own observations at our disposal.

We wish specially to express our thanks to Professor W. R. Browne for his criticism of this paper. Our thanks are due to Miss Irene Crespin and to Mr. F. W. Booker for help in their special branches of palaeontology. We have had to refer often to Mr. J. H. Reid's papers on the Queensland Upper Palaeozoic beds and would here record our appreciation of his work.

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THE STATUS OF "*MUS*" *NOVAEHOLLANDIAE* WATERHOUSE, AND ALLIED FORMS.

By

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As the subdivisions of the pseudomyid group of rats and mice are essential to the discussion of individual relationships, it is appropriate to emphasize that in 1910 Oldfield Thomas stressed their importance when defining the subgenera of *Pseudomys* (*sensu lato*) by stating that: "This genus contains species of very varied skull and molar structure, and it is with some hesitation that I leave such diverse species as, for example, *P. australis* and *P. forresti* under the same generic heading."

It is therefore clear that his subdivisions were not merely tentative, as suggested by Finlayson, but that it was actually their subgeneric status which Thomas considered possibly inadequate, when hesitating to retain them under the one genus. The elevation of the four subgenera to generic status in the Check-List by Iredale and Troughton[1] is therefore in accordance with the views of Thomas, as confirmed by his fixation of the subgenera by the nomination of genotypes, comparative diagnoses, and grouping of their known forms.

A striking example of the value of generic distinction, between species of close external resemblance, is provided by the central Australian *Gyomys desertor* Troughton, 1932, which authors previously confused with the south Western Australian *Thetomys nanus* Gould, 1858. The cranial and dental features actually represent the extremes in group distinction, *Thetomys* having the strongly concave zygomatic plate and subsidiary cusp to m^1, in contrast with the normal plate profile and absence of cusp in *Gyomys*.

Even if intergradation shown by extensive material eventually merges *Thetomys* with *Pseudomys* (*sensu stricto*), it is surely evident that the species of these allied genera, possessing the concave zygomatic plate, must be generically distinguished from the smaller *Leggadina* and *Gyomys*, which have the normally murine straight or convex zygomatic profile. Regarding the inference that variability affects the diagnostic value of the antero-internal cusp on m^1, presence or absence of which separates the pairs of allied genera, it is notable that a similar cusp distinguishes the Indian genus *Leggada*, upon which name Thomas based that of one of the subgenera, further emphasizing their generic distinction.

As possession of the subsidiary cusp is supported by differences in pterygoid and molar structure in distinguishing *Leggadina* from *Gyomys*, and the more normal pterygoid and molar pattern is associated with a subsidiary cusp in separating *Thetomys* from *Pseudomys*, there appears to be no present justification for withholding generic status, of such practical value in dealing with complex relationships.

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[1] For general references, see Iredale and Troughton.—Check-List of the Mammals Recorded from Australia, Mem. Austr. Mus., vi, 1934.

Regarding the status of *Leggadina*, it is clear that the extension of the subsidiary cusp almost to form an additional lamina in the genotype (*forresti*) cannot be reconciled generically with the complete absence of antero-internal molar cusps in *Gyomys*. The lamination of the cusp is even more pronounced in *berneyi* of central-western Queensland which, on comparison with additional allied material, now proves to be a species of *Leggadina*, allied to the northern *forresti*. Although a diminution of the cusp occurs in southern allies of *forresti*, approaching the tubercular *Leggada*-like cusp of *hermannsburgensis*, there is a coincidence of range of the large- and small-cusped groups, indicative of specific distinction.

The large-cusped shorter-tailed *forresti* group is represented inland from north to south by *forresti*, *berneyi*, *waitei*, and *messorius*, which occurs in the Spencer's Gulf – Lake Frome area. The smaller-cusped longer-tailed *hermannsburgensis*, originally described from west of Alice Springs, and apparently inhabiting somewhat different country, has been listed doubtfully by Thomas from the Northern Territory, and recorded as a geographical race from south-west South Australia. It now seems that another and more distinct south-eastern race is represented by the Blandowski series from western Victoria, which was recently listed erroneously as being identical with the rare *Gyomys* genotype, *novaehollandiae*, of north-eastern New South Wales.

As a final example of the importance of generic distinction, recent examination of the skull of the unique type of *Mus fieldi*, described by Waite as "so utterly crushed that not a single measurement of the bones could be made", provided a character placing the species in the genus *Pseudomys* (*s.s.*), instead of *Leggadina*, in which authors tentatively placed it without diagnostic evidence.

The general features and importance of the pseudomyid divisions have been reviewed in some detail to assist in avoiding the confusion arising from such errors in identification, based upon inadequate or wrongly classified material. In associating the name of Mr. C. W. Brazenor with the following correction, it may be stated that one is in complete accordance with his view that workers in "museums possessing extensive series, even of single species, should publish a critical survey", but, as a general corollary, it is suggested that workers should also fully consider and quote such contributions, preliminary to drastic alteration of generic or specific relationships.

Gyomys novaehollandiae Waterhouse.

Pseudomys (*Leggadina*) *novaehollandiae* Brazenor (*nec.* Waterhouse), Mem. Nat. Mus. Vict., ix, 1936, pp. 9–13, pl. ii, a-d.

In the paper quoted, Brazenor provides what is stated to be an extended description of the rare *Gyomys novaehollandiae* of north coastal New South Wales from Victorian material, upon examination of which that species is transferred to the "subgenus" *Leggadina*, and also erroneously added to the Victorian faunal list. The description, however, is based upon a series of mice from the drier north-west region of Victoria which, as the author indicated, are closely allied with a central Australian species.

The colour, dentition, and dimensions are described as intergrading so well with the central *L. hermannsburgensis* that only the difference in tail-length and range justified separation of the Victorian specimens. In view of this similarity, and the far greater disparity of range involved with the coastal *novaehollandiae*, it seems remarkable that Brazenor should have regarded this species as even more closely identifiable with the Victorian series. Equally surprising was the transference of this typical species of *Gyomys* to the "subgenus" *Leggadina* without autoptic examination of the dentition.

The type of *novaehollandiae* provided the basis of *Gyomys*, when Thomas gave the main diagnostic feature as the absence of an antero-internal cingular cusp to m^1, associated with normal murine laminae, whereas in *Leggadina* a well-marked antero-internal cusp is invariably present, with a consequent tilting backwards of the inner edges of the laminae, and reduction of the outer cusps. The very evident development of the subsidiary cusp in *Leggadina hermannsburgensis*, as shown by Brazenor's illustrations, makes it obvious that Thomas could not have overlooked the presence of such cusps in *novaehollandiae*, which *must* always be regarded as typical of the *Gyomys* section of the pseudomyid group.

The identification of the Victorian series with *novaehollandiae*, contrary to geographical distribution and at least subgeneric distinction, was based upon the necessarily superficial comparison of two "old collection" specimens with the type, kindly undertaken by Mr. M. A. C. Hinton, Keeper of Zoology at the British Museum. Although the material is stated to be in perfect agreement, no reference is made by Brazenor to the actual presence of antero-internal cingular cusps in the type of *novaehollandiae*, necessary to link it with a form of *Leggadina*.

Actually, specific distinction is clearly shown by the upper molar length of 3·5 mm. in the Victorian animal as opposed to 4·1 mm. given as typical of *novaehollandiae* by Thomas. The proportionately much longer tail of 74 mm., opposed to the 51 mm. given for the typical specimen, further emphasizes the distinction between animals of similar head and body length. In view of the fact that, apart from generic distinction, specific differences are supported by geographical range, it is evident that the extended description of the Blandowski series cannot possibly be considered representative of the coastal *novaehollandiae*, which remains typical of the genus *Gyomys*, and as yet unrecorded from Victoria.

In order to emphasize the central Australian affinity of the Victorian series of *Leggadina*, and prevent the inevitable confusion arising from mis-identification involving the status of genera, the Blandowski series listed by Brazenor is now recognized as a distinct form.

Leggadina hermannsburgensis brazenori, subsp. nov.

Diagnosis.—Size of body, pes, and ear much as in typical form of central Australia, but tail proportionately much shorter, and palatal length apparently greater. Colour of fresh specimens doubtless exhibiting variation due to difference in habitat.

Descriptive Notes.—General colour above given as about buffy-brown pencilled with darker hairs, lighter on sides and limbs, with the underparts soiled buffy-white, and the manus and pes buffy-white, the general tone probably darker than the typical form in fresh specimens. Tail equalling the head and body, instead of being decidedly longer. Pes and ear length given as being much as in typical race, but measurements are from dry material.

Total length of skulls not available, but the skull proportionately larger, judging by the greater palatal length of 12·3 opposed to 11·2 mm., in an animal of somewhat smaller size; it is notable that this comparison applies only if Brazenor's measurement is taken to the gnathion, and not to the nasal-tips as Waite did in measuring the typical form. Molars of similar size, with tilted laminae typical of the genus, and the small somewhat variable antero-internal cingular cusps common to the species.

Lectotype.—The specimen in the National Museum, Melbourne, for which the following measurements were listed: Head and body 75; tail 74; pes 19; ear 15·8 mm.

Skull: Back of parietals to nasal-tips 20; nasals 7·5 × 2·3; interorbital width 3·5; palatal length 12·3; palatal foramina 4·3; upper molars 3·5 mm.

Habitat.—The original description was based upon a series of 27 specimens which were collected near the junction of the Murray and Darling Rivers by the explorer-naturalist W. Blandowski in 1857.

Remarks.—The Victorian race is evidently distinguishable by the proportionately much shorter tail; doubtless the coloration and complete cranial features of fresh specimens would further emphasize differences due to geographical separation and habitat.

In regard to Brazenor's merging of the southern race (*bolami*) with the typical form, on the ground of seasonal variation in arid regions, it is stressed that a geographical race and not a full species is involved, so that intergradation is to be expected. Although Brazenor noted a slight colour distinction, he did not review the cranial features cited, and it is notable regarding his table of external dimensions that the Victorian ones are from an entirely dried series in which ear measurements would be affected by the skinning and cutting away of the skull-base, while there is no separation of sexes in the three groups listed, and material of unspecified central localities is included.

Whether the relatively large variation of 3 mm. shown in maximum pes and ear lengths of 20 and 16·5 mm. respectively is due to the condition of material or method of measurement, such variation in small mice "taken in the same place at the same time" appears somewhat contradictory of the theory that marked size variation in desert forms is caused by prolonged changes of drought and plenty. It has, however, recently become rather a convention for local workers to stress such variability of size in discrediting established forms, while describing new ones based mainly upon size from central areas without comparative analyses.

The merging of species and races with type localities from 500–1,000 miles apart on the grounds of seasonal change appears to represent the opposite extreme to the past fallacy of according far too extensive ranges to individual forms. In view of the distance and intervening variations of habitat, it is considered that *bolami* is separable as a colder-toned race of *hermannsburgensis*, with the interorbital averaging wider and the palatal foramina longer, the teeth slightly heavier, and the nasalia broader in the posterior half and therefore with somewhat more sinuous sides.

The much greater geographical separation of *brazenori* from the typical form, and the richer habitat indicated by the C.S.I.R. Vegetation Map, doubtless reflected in the fresh coloration as well as in the characters reviewed, leaves no doubt of the distinction of this form.

Pseudomys fieldi Waite.

Mus fieldi Waite, Rept. Horn Exped., ii, 1896, pp. 403–4, pl. xxvi. *Id.*, Thomas, Proc. Zool. Soc., 1906, p. 539.

Pseudomys (*Leggadina*) *fieldi* Longman, Mem. Qld. Mus., v, 1916, p. 32.

The generic identity of this species has remained in doubt since the description of the unique specimen in the Australian Museum collection, the skull of which was so badly crushed that it could not be measured. The molar row, however, was figured by Waite, who remarked that the teeth were very similar to those shown for *hermannsburgensis*, excepting that the antero-internal cusp of m^1 was "extremely small".

The relative minuteness of the cusp in the decidedly larger tooth-row, however, was sufficient to discredit this comparison, and it was surprising that Thomas (1906) should consider *fieldi*, apart from the much longer tail, apparently near his *forresti*, in which the antero-internal cusp is unusually developed, almost forming a supplementary lamina. As a result of this comparison, no doubt, *fieldi* was included in the subgenus *Leggadina* by Longman in his List of Muridae in 1916.

The diagnostic importance of the subsidiary cusps, and uncertainty concerning *fieldi*, had previously been indicated, however, when Thomas refrained from allotting the species to any of the subgenera which he defined in 1910. Unfortunately, the molar rows of the type were apparently lost after removal for illustration, but recent examination of cranial remains *in situ* in the spiritous holotype revealed a complete zygomatic plate with the projection above and concave margin characteristic of *Pseudomys* and the allied *Thetomys*, instead of the normally murine straight to convex profile of *Leggadina*.

In Waite's illustration the "extremely small" subsidiary cusp is more suggestive of the small cingular rugosities occasionally observed in *Pseudomys* (*s.s.*), rather than the distinct antero-internal cusp on m^1 diagnostic of *Thetomys*, which genus is so far unrecorded from the centre. Therefore, from the indefinite nature of the cusp, associated with the concave zygomatic plate, and geographical range, it is evident that "*Mus*" *fieldi* is a species of *Pseudomys* (*s.s.*) allied to *Ps. minnie* of N.E. South Australia, which is represented by the subspecies *flavescens* in central western Queensland.

It is notable concerning the specific characters of *fieldi* that the holotype, taken at Alice Springs in June, 1895, was a fully adult suckling female, which Waite described as having a thin and very long tail, considerably longer than the head and body. All specimens of *Ps. minnie*, on the contrary, have the head and body definitely longer than the tail, and from a general comparison of dimensions there appears no doubt that *Ps. fieldi* is readily distinguishable from its nearest ally by the relatively much longer tail, as well as in having definitely smaller ears, pes, and molar rows.

Although long spirit preservation renders colour comparison of the holotype unsatisfactory, the "warm sandy-brown" of the original description would seem to be decidedly richer and lacking the more buffy tone of *Ps. minnie*, thus confirming the specific distinction of *fieldi* which, in common with *L. waitei*, supports a general impression of the distinctive faunal conditions about Alice Springs.

Note.

While reviewing various accounts of Austro-Malayan Muridae, concerning the relationship of New Guinea forms, it was noted that *Epimys* (= *Rattus*) *ravus* Robinson and Kloss[2] antedates *Rattus greyi ravus* Brazenor,[3] for which the subspecific name of *peccatus* is now submitted.

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[2] Robinson and Kloss.—Journ. Straits Branch Roy. Asiatic Soc., No. 73, 1916, p. 272.

[3] Brazenor.—Mem. Nat. Mus. Melb., x, 1936, p. 69.

Summary.

1. The subgenera of *Pseudomys* were not tentatively proposed, their author hesitating to leave all four subdivisions under the one generic heading.

2. The markedly concave zygomatic plate distinguishes *Pseudomys* and *Thetomys* generically from *Leggadina* and *Gyomys*, irrespective of whether intergradation subsequently merges the two former.

3. Absence of any trace of subsidiary cusp to m^1 in *Gyomys* distinguishes it generically from *Leggadina*, in which an obvious cusp persists in the most worn condition.

4. The extended description of the west Victorian mice cannot be applied to *novaehollandiae* of north coastal N. S. Wales, which remains the type of *Gyomys*.

5. The Blandowski series from Victoria represents a new race of the central Australian *L. hermannsburgensis* (*brazenori*), and *bolami* of S.W. South Australia is reaffirmed as a naturally variable but recognizable race of that species.

6. On comparison with additional allied material *Gyomys berneyi* proves to be a species of *Leggadina*, allied to *forresti*.

7. Upon re-examination of the holotype, *Mus fieldi* Waite, 1896, is shown to be a species of *Pseudomys* (*s.s.*) allied to *minnie*, but specifically distinct.

8. The subspecific name *peccatus* is proposed for the Victorian race of *Rattus greyi*, in lieu of *ravus* Brazenor, 1936, *nec. Rattus ravus* Robinson and Kloss, 1916.

9. It should be noted that Tate[4] was mistaken in giving the mammary formula in his *Rattus assimilis* "Group" as 0–2=4, when reviewing and charting the phylogeny of Indo-Australian Muridae, a formula occurring in Australian rats of the pseudomyid and *Uromys-Melomys* groups only.

In *R. assimilis* the mammary formula is 2–1–2=10, and the actual affinity is obviously with the true *R. rattus* and *R. tunneyi* groups, rather than with the more "ancient derivative" *R. chrysocomus* group of the Philippines and Celebes as Tate inferred.

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[4] Tate.—Bull. Amer. Mus. Nat. Hist., lxxii, art. 6, 1936, pp. 501-728.

NOTES ON AUSTRALIAN CERAMBYCIDAE.

III.

Description of a New Species of *Ceraegidion*.

By

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(Figures 1–6.)

FOR over one hundred years the genus *Ceraegidion*, ever since its determination by Boisduval in 1835, has been represented by only one species, its monotype, *C. horrens*, one of the most remarkable of described Australian Cerambycidae. The discovery of a second species is, therefore, of considerable interest and importance.

Ceraegidion horrens was described by Boisduval in the "Voyage . . . de L'Astrolabe . . . pendant les Années 1826–1827–1828–1829" in 1835 (p. 492) from a specimen "découvert dans le nord de la Nouvelle-Hollande, par M. Cunningham". This description was republished in full, accompanied by a plate, in *Magasin de Zoologie*, v, Cl, pl. 124, in the same year. The plate illustrates a male, the dorsal view in colour and a lateral one in line.

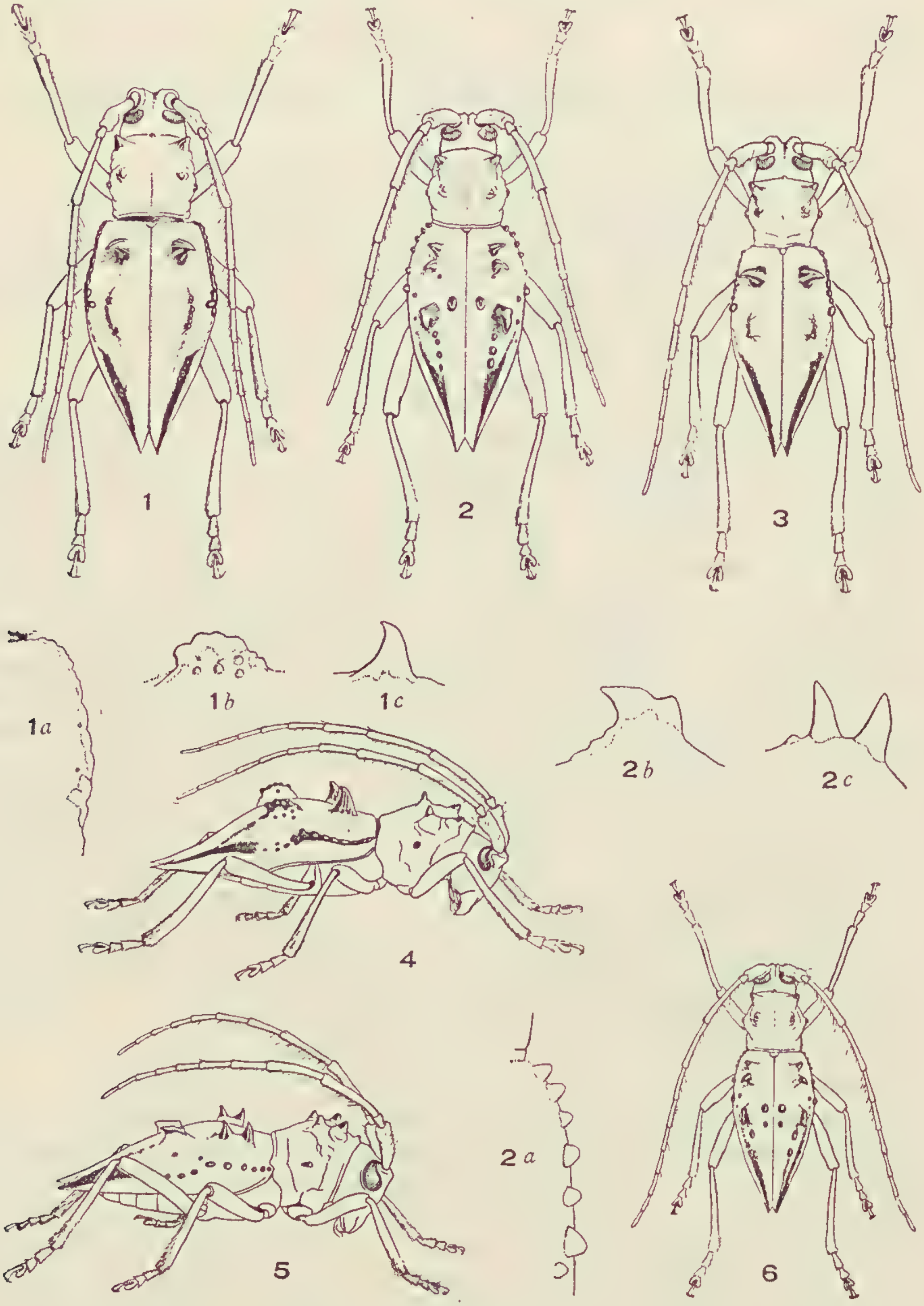
In 1864, Thomson, in his "Systema Cerambycidarum" (p. 40), gave the locality of the species as "Nlle. Zélande (*teste Bowring*)", which was quite erroneous.

C. French, senr., in a note published in 1889 in the *Victorian Naturalist* (vi, 7, Nov., p. 120), recorded the capture of a specimen of *C. horrens* at Croajingalong, East Gippsland, Victoria. In the substance of this note several curious errors occur. The capture of the specimen described by Boisduval is attributed to "the late R. Cunningham, brother of the well-known traveller and botanist, A. Cunningham, in New South Wales, and described . . . . in the 'Voyage' of the French war-ship *Astrolabe* in 1827 . . . . in which fine work it is also figured".

The original specimen must have come from A. Cunningham, and not R. Cunningham as suggested by French, since the *Astrolabe* was in Australian waters from 1826 to 1829, whereas R. Cunningham did not arrive in Sydney until January, 1833, and was lost while with Mitchell's Expedition in 1835. A. Cunningham, on the other hand, reached Port Jackson in December, 1816, remaining in Australia until February, 1831; returning in February, 1837, so that there was every opportunity for Boisduval to have obtained the insect from him. Further errors occur with regard to the date of the "Voyage of the *Astrolabe*" and the figure. The work was published in 1835, and not 1827 as stated by French, for at this time the expedition was still in Australia. No figure of

C. horrens occurs in the book, but, as stated above, it was figured later in the *Magasin de Zoologie.*

In connection with the locality, "North Australia", given by Boisduval, it would appear to be inaccurate. All the specimens of *C. horrens* I have examined



Figures 1-6.

Ceraegidion dorrigoensis, sp. nov.: 1, ♀; 3, ♂; 4, lateral view of ♀. *C. horrens* Boisd.: 2, ♀; 6, ♂; 5, lateral view of ♀. *a*, lateral tubercles of elytra; *b*, elytral crest; *c*, elytral spine.

N. B. Adams, *del.*

have come from the South Coast of New South Wales, and the majority of them from the Illawarra district, none of them coming from the north. It is interesting to note with regard to the locality that A. Cunningham visited Illawarra, Blue Mountains, and the Bathurst-Mudgee district in August 1822 (*teste*, "Australian Illustrated Encyclopaedia"), while the late W. W. Froggatt, in his "Australian Insects", 1906, recorded *C. horrens* as being "not uncommon in the Illawarra district, N.S.W." The range of *C. horrens* would, therefore, appear to extend over the South Coast area of New South Wales (centring around the Illawarra district), and continuing to East Gippsland, Victoria.

Ceraegidion dorrigoensis, sp. nov.

Robust; black, somewhat densely clothed with a very short pile of a light brown colour, sprinkled with numerous small patches of a longer, bright orange pile.

♀. *Head* densely clothed with varied brown and orange pile, with a shallow impressed median line, becoming deeper and more marked between the antennary tubercles. Antennary tubercles with a naked lunulate area of nitid red derm at base.

Antennae almost reaching the extremity of the body, clothed with a coarse brown pile varied with orange-yellow. The first joint is liberally sprinkled with yellow patches, and this colour is somewhat concentrated toward the bases of joints 2 and 3. A sparse fringe of long golden hairs along the undersurface of the antennae, decreasing in length from base to apex.

Thorax longer than wide, parallel, strongly quadrispinose on disc. An obtuse nitid black lateral tubercle, a very small nitid black tubercle in the centre of the extreme anterior margin of the prothorax. The four discal spines are placed somewhat anteriorly; the anterior pair stout and acute, directed forwards, are black and nitid; the posterior pair erect, their bases densely covered with pile, and their apices only nitid. An elongate linear area of dark derm extends backwards from between the posterior tubercles.

Elytra triangular, considerably broader than thorax at base; rounded and becoming much widened for about one-third of their length, then decreasing sharply in breadth and terminating in acutely spined and dehiscent apices. Two stout and acute spines on disc of elytra close to base, black, nitid, and posteriorly recurved, their shape being like that of rose thorns; two prominent narrow crests about half-way, with their apical ridges black, nitid, and multituberculate. The anterior lateral third of elytra with a row of coalescing, nitid, black tubercles, producing a moniliform appearance. Posterior third of elytra with a narrow, somewhat lateral, area of black derm extending to the extremity of the apices. Suture narrowly black.

Legs clothed with coarse brown pile, varied with orange-yellow spots. Posterior third of tibiae, and tarsi, clothed with long yellow hairs, giving them a golden hue.

Lower surface densely clothed with brown pile varied with orange; a narrow naked linear area (possibly abraded) along median line of abdomen.

♂. Moderately slender; similar to female, but with the elytral crests shorter and higher. *Antennae* longer than body.

Long., ♂♂, 19–22 mm., lat. 7 mm. Long., ♀♀, 22–25 mm., lat. 8–10 mm.

Hab.—Dorrigo, New South Wales (W. Heron), January, 1929.

Types.—Holotype ♀, allotype ♂, and paratype ♂ and ♀ in Australian Museum, Sydney.

Ceraegidion dorrigoensis bears a superficial resemblance to *C. horrens*, but differs from that species in the single, and not bifid, anterior spines on the elytra; the longer and multituberculate apices of the elytral crests, and the absence of the pair of nitid, rounded tubercles in the depression between and slightly in advance of the elytral crests, together with the lateral row of moniliform tubercles which are joined in a continuous series, whereas in *C. horrens* they are fewer, separated, and more scattered. The difference in the shape of the elytral crests is very marked, those of *horrens* being higher, shorter, smooth on the apex, which tends to be produced into a somewhat recurved point. The vestiture is very similar in both species.

Both sexes of *C. dorrigoensis* are rather stouter in build than in *C. horrens.*

It is remarkable that the new species has for so long escaped the notice of entomological workers, for material from the Dorrigo district is by no means uncommon in a number of collections, where the specimens have apparently been accepted as being *C. horrens*; indeed, the holotype ♀ and allotype ♂ bear A. M. Lea's labels identifying them as that species.

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NATIONAL MUSEUM OF VICTORIA

NATIONAL MUSEUM OF VICTORIA

STUDIES IN ICHTHYOLOGY.

No. 11.*

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(Plate xxi, and Figure 1.)

Family OPHICHTHYIDAE.

Genus **Malvoliophis** Whitley, 1934.

Malvoliophis Whitley, Rec. Austr. Mus., xix, 2, March 26, 1934, p. 154. Orthotype, *Bascanichthys hemizona* Ogilby.

Malvoliophis pinguis (Günther).

(Fig. 1.)

Ophichthys pinguis Günther, Ann. Mag. Nat. Hist. (4), x, Dec. 1, 1872, p. 425. Salomon Islands. Type in British Museum. *Id.* Günther, Cruise Curaçoa (Brenchley), 1873, p. 430, pl. xxxv. *Id.* Günther, Journ. Mus. Godeff., vi, 17, 1910 (Fische d. Südsee, ix), p. 399. *Id.* Borodin, Bull. Vanderbilt Mus., i, 1932, p. 71.

Bascanichthys hemizona Ogilby, Proc. Linn. Soc. N.S. Wales, xxii, 2, Oct. 25, 1897, p. 248. Port Jackson, N.S. Wales.

Bascanichthys pinguis Waite, Rec. Austr. Mus., iv, 1901, p. 53, *et ibid.*, v, 1903, p. 22 (Lord Howe Island). *Id.* McCulloch, Austr. Zool., ii, 1921, p. 35, pl. viii, fig. 86a, and Austr. Mus. Mem., v, 1929, p. 70.

Ophichthus pinguis Fowler, Mem. Bern. P. Bishop Mus., x, 1928, p. 44.

Malvoliophis pinguis Whitley, Rec. Austr. Mus., xix, 1934, p. 154; Abstr. Proc. Linn. Soc. N.S. Wales, 497, May, 1937, p. 1.

Three post-larval specimens, 41, 45, and 48 mm. long, have been referred to this species, the middle-sized specimen being selected for describing and figuring here.

Head (6·4 mm.) 7, depth (2·5) 18 in total length (45). Eye (1) wider than interorbital, and slightly wider than dark bands on body.

The head is conic, the mouth being inferior, reaching backward to below the anterior half of the eye. The end of the upper jaw considerably overhangs the lower. Rows of fine acute teeth in jaws, the anterior ones caniniform. About four branchiostegal rays can be seen through the skin. The gill-slits are difficult to distinguish, being tiny slits, lateral in position. Eye large, somewhat oval, not cutting dorsal profile; interorbital widest posteriorly. The nostrils are inconspicuous, the anterior ones occupying short tubes on upper lip, and posterior ones somewhat in front of eyes. Lateral line feebly developed for a short distance anteriorly.

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* For No. 10, see RECORDS OF THE AUSTRALIAN MUSEUM, Vol. xx, No. 1, May, 1937, p. 3.

Body elongate, compressed. The consistency of the flesh is firm and muscular, not gelatinous as in a *Leptocephalus* larva; there may have been slight shrinkage through fixation in methylated spirits. There are sixty-three myomeres between head and tip of tail. By counting these from the occipital region backwards, we find:

Nos. 1 to 3 just behind vertex of head,
No. 4 over first dark band of colour on body,
Nos. 5 to 9 between first and second bands,
No. 10 on second band,
Nos. 11 to 16 between second and third bands,
No. 17 on third band,
Nos. 18 to 24½ between third and fourth bands,
Nos. 24½ to 25 on fourth band,
Nos. 26 to 31½ between fourth and fifth bands,
Nos. 31½ to 33½ on fifth band,
Nos. 33½ to 63 to end of tail.

This low number of myomeres is noteworthy, since most eel larvae have at least 100. Furthermore, it is deduced that the larva of this species must be a large one, since these specimens are practically metamorphosed at 41–48 mm. The anus is in the anterior half of the fish, between the third and fourth band, at the twenty-first myomere. The belly is somewhat rounded in transverse section anterior to anus, but the body is very compressed posteriorly, so that the vertebrae of the tapering tail region may be seen when the specimen is held against the light.

No fin-membranes are apparent anywhere. The dorsal and ventral profiles are, however, scalloped between the rather prominent interhaemal spines. Dorsally the scalloping commences immediately behind the head, but ventrally it starts behind the vent. No pectoral fins. Tail ending in a free point.

Colour, in spirit, yellowish-brown with some groups of sparse dark compact chromatophores on sides of head and top of snout. The fish is encircled by five prominent bands, chocolate brown in colour, and strongly contrasted with the ground colour; only the hindmost of these bands trespasses on the posterior half of the fish, and the anterior bands are closer together than the others.

Locality.—About one mile off Jervis Bay heads, southern New South Wales; trawled in Danish seine net in 26 fathoms by Mr. Thomas Webb aboard the "Nannegai". Three specimens presented by Mr. Melbourne Ward; Austr. Mus. Regd. No. IA.7115.

The 41 and 48 mm. specimens have not developed the cross-bands which are so prominent in the 45 mm. example figured. However, they have the same number of myomeres (63), similar clusters of rusty red spots on the head, and even some milky spots on opercles.

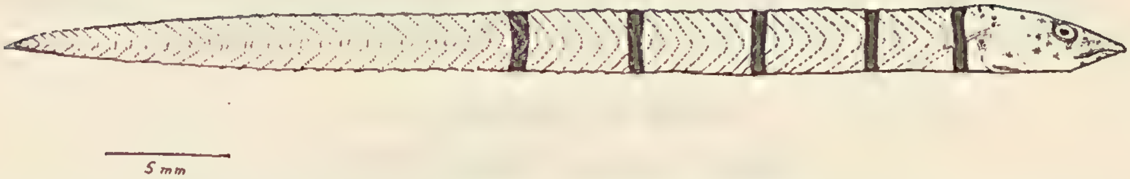

Fig. 1.—*Malvoliophis pinguis* (Günther). A juvenile specimen, 45 mm. in total length, from off Jervis Bay, New South Wales. Austr. Mus. Regd. No. IA.7115.
G. P. Whitley, *del.*

Malvoliophis pinguis has been recorded from the Solomon Islands, Lord Howe Island, and New South Wales, but it is by no means common. Thus it is all the more remarkable that three specimens should have been caught at once at Jervis Bay, also that they should have inhabited fairly deep water (though the bare possibility that they entered the net as it was being hauled must not be overlooked), since most eel larvae are pelagic. Some features of these young specimens disagree with the adults. The mouth does not extend beyond the eye, there are no pectoral fins, the coloration when present is symmetrical, and the body and tail are less elongate in the Jervis Bay juveniles. It is thought, however, that these features will alter with age and growth; concerning the presence or absence of pectoral fins in young eels, Eigenmann and Kennedy[1] have found that this depends at times on the age of the specimen. The structure of the head, the free tail-tip, and the coloration of my Jervis Bay specimens show that they are Ophichthyidae and point to the probability of their being *Malvoliophis*.

The Snake Eels or Ophichthyidae are stated by Jordan and Snyder[2] to produce eggs which are "numerous, of moderate size, similar to those of ordinary fishes". Very little is known about the *Leptocephalus* stages of this family, especially as compared with the Muraenidae, Leptocephalidae (Congers), and some of the deep-sea eels. It is possible that the Ophichthyidae are inshore breeders and that there is not a long period spent in the *Leptocephalus* stage. The adults are strikingly coloured, like banded sea-snakes, and different genera have developed very similar patterns, suggesting mimicry. The Ophichthyidae should probably be far removed in classification from the true eels like Anguillidae. Some extraordinary features of the Ophichthyidae have been noted by Deraniyagala,[3] who observed the breeding habit of *Leiuranus*, where the male gripped the swimming female in his jaws for hours before fertilization of the eggs took place. The same investigator[4] noted that *Ophichthus apicalis* selects the urogenital passages of large percoid fishes as a hiding place for part of its life. Thus any data concerning the young or the life-history of these fishes are of zoological interest.

Family LEPTOCEPHALIDAE.

Facciolella, gen. nov.

Nettastomella Facciolà, Bolletino della Società Zoologica Italiana (3), iii, 1914, p. 47. Haplotype, *N. physonima* Facciolà. Name preoccupied by *Nettastomella* Carpenter, Proc. Zool. Soc. Lond., 1865 (June 13, 1865), p. 202, a genus of Mollusca.

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[1] Eigenmann and Kennedy.—Bull. U.S. Fish. Comm., xxi, 1901 (1902), p. 83.
[2] Jordan and Snyder.—Proc. U.S. Nat. Mus., xxiii, 1901, p. 863.
[3] Deraniyagala.—Spolia Zeylanica, xvi, 1, Sept. 8, 1930, p. 107.
[4] Deraniyagala.—Spolia Zeylanica, xvi, 3, March 18, 1932, p. 355.

This genus of eels has been given a preoccupied name and is accordingly renamed as above, with *Facciolella physonima* (Facciolà) as orthotype.

Family ATHERINIDAE.

Genus **Pranesus** Whitley, 1930.

Pranesus endrachtensis (Quoy and Gaimard).

Atherina endrachtensis Quoy and Gaimard, Voy. Uranie Zool., 1825, p. 334. Shark's Bay, Western Australia.

D.vi/9 in larger specimen (10 in smaller specimen); A.i/12 (13 in smaller); P.15. Sc.40 (41). Tr.6. 17 predorsal scales.

Head (28 mm.) 3·5, depth (25) subequal to pectorals (25) 4 in standard length (100). Eye (10) 2·8, snout (7) 4 in head. Interorbital (11·5) wider than eye.

Breadth 15 mm. at level of pectorals. Head scaly, except anteriorly, and without spines. Eye large. Mucus pores cavernous, especially on top of head. Premaxillaries not dilated posteriorly. Premaxillary process short, about ½ diameter of eye. Maxillary reaching level of anterior third of eye. Rami of mandibles not elevated inside mouth. Tiny villiform teeth in jaws and on vomer. Gill-rakers slender, numerous.

Body elongate, robust, wholly scaly. Anus situated between tips of adpressed ventrals; these tips do not quite reach level of origin of first dorsal fin.

First dorsal origin nearer root of tail than snout. Anterior rays of fins longest. Anal origin opposite dorsal interspace. Anal base equal to its distance from first caudal rays. Pectorals lateral, dusky towards tip. Ventral origin not far behind level of that of pectoral. Caudal strongly forked.

Colour yellowish with the back-scales darkly stippled and greenish. A broad silvery to greyish lateral stripe. Front of head and a blotch near pectoral tip dusky.

Loc.—Swan River estuary (marine), Western Australia. Presented by Dr. D. L. Serventy. Two specimens in Austr. Mus., IA.7187–8.

Family MELANOTAENIIDAE.

Genus **Aidaprora** Whitley, 1935.

Aidaprora carteri Whitley.

(Plate xxi.)

Aidaprora carteri Whitley, Rec. Austr. Mus., xix, Sept. 19, 1935, p. 224. Flinders River and adjacent pools near Hughenden and Richmond, Central Queensland. Types in Australian Museum, Sydney.

Mr. A. K. Carter, after whom this hitherto unfigured species was named, has made the very beautiful and accurate drawings, which are here reproduced, from male and female paratypes (Austr. Mus. Regd. Nos. I.13092 and 13096).

I venture to predict that this striking freshwater fish may one day be at least as popular amongst aquarists as the ordinary 'Sunfish' or Australian Rainbow-fish (*Melanotaenia*).

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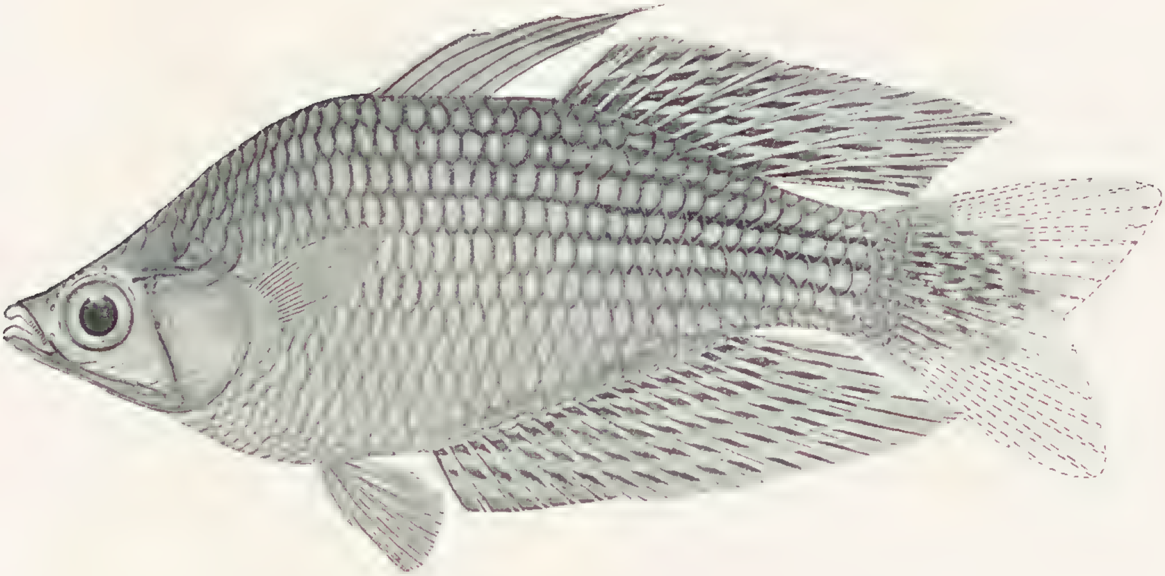
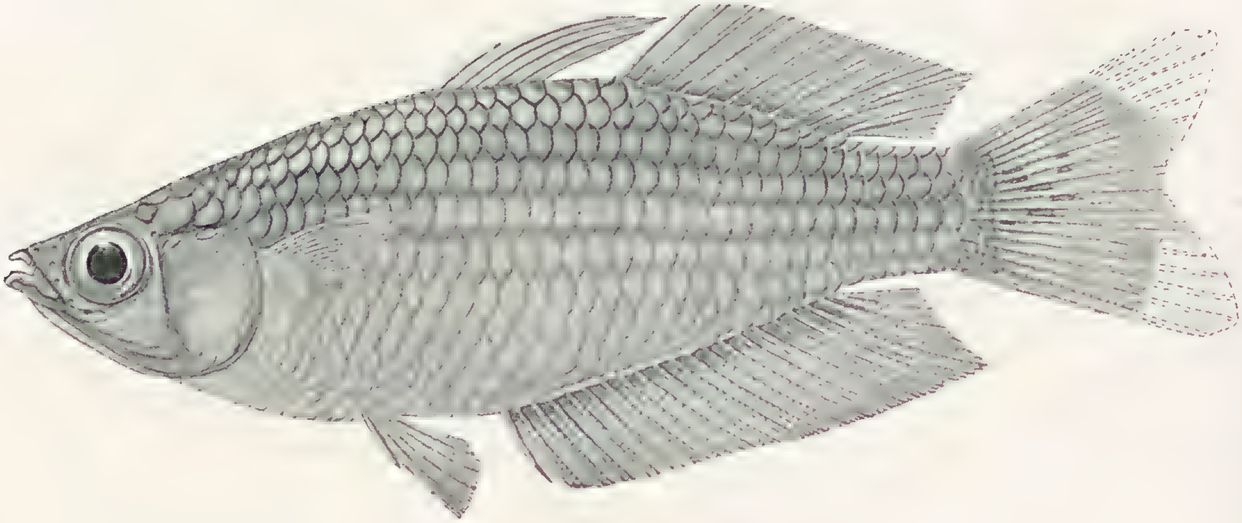




A. K. CARTER, *del.*

Family PLATYCEPHALIDAE.

Genus **Trudis** Whitley, 1931.

Trudis bassensis westraliae, subsp. nov.

Platycephalus bassensis of Western Australian records, not strictly *P. bassensis* Cuvier and Valenciennes, Hist. Nat. Poiss., iv, Nov., 1829, p. 247, from Westernport, Victoria.

On comparing two small Western Australian specimens sent by Dr. D. L. Serventy with true *bassensis* in the Australian Museum, I note that the western specimens have about 85 scales along the lateral line, the occipital ridges prominent above the skin, the eye one-fifth length of head, and the black blotch on the caudal fin reaching forward almost to caudal root, rather as in *Platycephalus arenarius* Ogilby.

Specimens of *bassensis* have nearly all the occipital ridges obsolete or buried under the skin, the eye in young specimens of comparable size goes less than 4 into the head (5 times in adults) and thus the eyes of the Western Australian specimens are comparatively much smaller. Ogilby's type of *P. arenarius* has eyes more than 7 in head, maxillary extending further back, and is more finely spotted.

In view of the above distinctions, I provide a new subspecific name for the Western Australian fish.

Loc.—Swan River estuary (marine), Western Australia; Dr. D. L. Serventy.

Holotype (IA7189) and paratype (IA.7190) of the subspecies in the Australian Museum.

Included amongst some fishes which Dr. Serventy submitted for identification are several which constitute new records for Western Australia, thus:

Austr. Mus. Regd. No.	*Name.*	*Locality.*
IA.7192.	*Arenigobius bifrenatus* (Kner.).	Swan River estuary (marine).
IA.7203.	*Arenigobius bifrenatus* (Kner.).	From stomach of cormorant, *Phalacrocorax varius.*
IA.7193.	*Stolephorus robustus* (Ogilby).	Fremantle.
IA.7197.	*Paraplotosus albilabris* (Cuv. and Val.).	Fremantle.
IA.7201.	*Maxillicosta scabriceps* Whitley.	Fremantle.

EXPLANATION OF PLATE XXI.

Aidaprora carteri Whitley.

Upper figure: male paratype (Austr. Mus. Regd. No. I.13092), 61 mm. in standard length.

Lower figure: female paratype (I.13096), 66 mm. in standard length. Both from Hughenden district, Central Queensland.

NOTES ON AUSTRALIAN CERAMBYCIDAE.

IV.

By

KEITH C. MCKEOWN,
Assistant Entomologist, Australian Museum.

(Plates xxii–xxiii, and Figures 1–5*a*.)

THE present paper contains the results of an examination of part of the unworked Cerambycidae in the Australian Museum collection, and includes descriptions of fifteen new species and one new genus, one new name, and notes on the synonymy of several other species. The critical examination of this material gives an indication of the wealth of species of Australian Longicorns which still awaits description.

Genus **Sceleocantha** Newman, 1840.

Sceleocantha cuneata, sp. nov.

(Figure 2.)

♀. Moderately robust, elongate, black, glabrous, nitid; palpi, legs, and antennae black. *Head* narrow, depressed, glabrous, nitid, coarsely punctate behind eyes, finely on clypeal area; strongly raised broad nitid ridges forming a V rising from base with its limbs extending to and contiguous with antennary tubercles; median line apparent only in the depression of frons between the eyes; mandibles black, nitid, coarsely punctate over external two-thirds, inner third impunctate; these areas are divided by a closely punctate channel. Front of mandible strongly convex. *Antennae* black, with scattered punctures. First joint markedly flattened on upper surface, joint 3 longer than 4, joints 4–11 about same length, joints 7–11 each with a flattened area on outer side more heavily punctate than elsewhere. Apical joint of palpus broadly spatulate. *Prothorax* narrower at base than elytra at shoulders, strongly transverse, without median line, apex lightly sinuate, not emarginate, with an inconspicuous fringe of short yellowish hairs; sides strongly produced, bidentate, the first tooth feeble and very slightly produced, the second broad, elongate and directed backwards; lateral margin of prothoracic expansions strongly sinuate; base of thorax markedly sinuate, lightly emarginate; disc glabrous, very nitid, with a few minute scattered punctures; lateral expansions irregularly and somewhat coarsely punctate. *Elytra* with a slight lateral curvature, most pronounced between one- and three-quarters of length; lightly emarginate, emargination becoming broadest about one-third from base where lateral declivity is steepest; apices sharply rounded, shoulders somewhat rounded, not pronounced; disc coarsely and irregularly punctate, the punctures becoming smaller and closer over apical eighth and lateral areas; basal punctures sometimes confluent.

Scutellum broadly rounded posteriorly, nitid, closely punctate, deeply concave. *Under-surface* black, prosternum and sternum sparsely pilose with greyish hair; abdomen strongly nitid, glabrous, minutely and sparsely punctate. *Legs* black, nitid, femora sparsely and minutely punctate; tibiae with much larger punctures; sparsely fringed on inner side with coarse black hairs; tarsi with a light clothing of short yellowish hairs; tibiae irregularly spined on outer edge (*e.g.*, first right tibia with one spine, left with three; second right with three, left with two; hind right with five, left with four).

Long. 33 mm.; lat. 15 mm.

♂ wanting.

Loc.—Dorrigo, New South Wales (W. Heron).

Holotype in Australian Museum, Sydney.

The species under review bears little resemblance to any other described species of *Sceleocantha*, and may be readily identified by the very distinctive shape of the head capsule, together with other features.

It is very interesting to find this new species occurring in the Dorrigo district, the type locality of *S. gigas*.

Sceleocantha carteri, sp. nov.

(Figure 1.)

♀. Robust; rather elongate, strongly convex; dark nigro-fuscous tending to reddish on lateral margins, glabrous, nitid; palpi, legs, and antennae dark castaneous. *Head* wide, depressed dorso-ventrally, closely and coarsely punctate on posterior margin, clypeal area, and around eyes; a small area on extreme apex sparsely punctate, nitid; median line shallow but well defined; mandibles black, nitid and sparsely punctate, the small punctures being most numerous on exterior angle towards base. *Antennae* dark castaneous; joint 3 a little longer than 4, joints 4–11 of equal length, but decreasing in stoutness from 5–11, nitid, glabrous, very sparsely and minutely punctate. Apical joint of palpus spatulate. *Prothorax* strongly transverse, median line broad, shallow and almost obsolete; apex truncate, narrowly emarginate, fringed with bright golden hairs, sides strongly produced, bidentate, the first tooth formed by the somewhat square anterior angle, the outer angle of which tends towards a posterior direction, the second very acute, slender, and directed backwards and outwards; lateral line of prothoracic expansion, between teeth, straight; base strongly sinuate, emarginate, fringed with coarse yellow hair. Disc glabrous, very nitid, with a few minute scattered punctures, a group of coarse punctures forming a pit postero-laterally on disc; prothoracic expansions coarsely and confluently punctate. *Elytra* parallel-sided, narrowly emarginate; apices narrowly rounded with an inconspicuous blunt sutural tooth; shoulders prominent, rounded; disc very coarsely and irregularly punctate, punctures frequently confluent, but becoming smaller on apical tenth, nitid impunctate intervals forming two indistinct lines on each elytron. becoming obsolete on apical fourth. *Scutellum* widely rounded, nitid, closely punctate at base, leaving an impunctate ⊥-shaped area bounded at the base by a deep transverse depression. *Under-surface* dark castaneous; prosternum and sternum densely clothed with long, velvety, yellow pile; abdomen glabrous, nitid, very sparsely and minutely punctate, apical segment with a small lateral patch of fine yellow hairs. *Legs* dark castaneous, nitid, almost impunctate, joints black; tibiae with a sparse fringe of coarse black hairs, and spined on outer edge (*e.g.*, front tibiae with three spines, second with five, third with six).

Long. 41 mm.; lat. 19 mm.

♂ wanting.

Loc.—Lane Cove, near Sydney, October, 1924.

Holotype (unique) in Australian Museum, Sydney.

This magnificent species is unfortunately represented only by a single specimen, which I take to be a female. It is only slightly smaller than *S. gigas*, from which it differs in its strongly convex elytra, coarser puncturation, and the shape of the prothoracic expansions, together with other differences. I am rather doubtful regarding the validity of the locality given on the label, but, as no further information is available, it must stand until further material is available.

I have great pleasure in naming this fine insect in honour of my friend, Mr. H. J. Carter, B.A., the well-known coleopterist who described *S. gigas*, the giant of the genus.

Sceleocantha garnseyi, sp. nov.

(Figure 3.)

♀. Robust; somewhat elongate, surface above nigro-fuscous, glabrous and semi-nitid; palpi, tarsi, and antennae dark castaneous. *Head* wide and broadly rounded, closely and finely punctate on apex and clypeal area, frons nitid with small scattered punctures. Mandibles black, not toothed, diffusely punctate, the punctures larger towards base and external angle, a slightly curved, wide, nitid linear depression extending from base to about two-thirds length. *Antennae* with first joint thickened, 3 longer than 4, 4–11 of equal length; all joints sparsely punctate; apical joint of palpus rather bluntly triangular, the base of triangle forming apex of joint. *Prothorax* strongly transverse, median line very faintly impressed, almost obsolete, apex subtruncate, strongly emarginate, fringed with coarse reddish hair; sides strongly produced, bidentate, the first tooth formed by the rounded anterior angle, the second acute, directed backwards and continuing the almost straight line of the lateral emargination; base sinuate, emarginate,

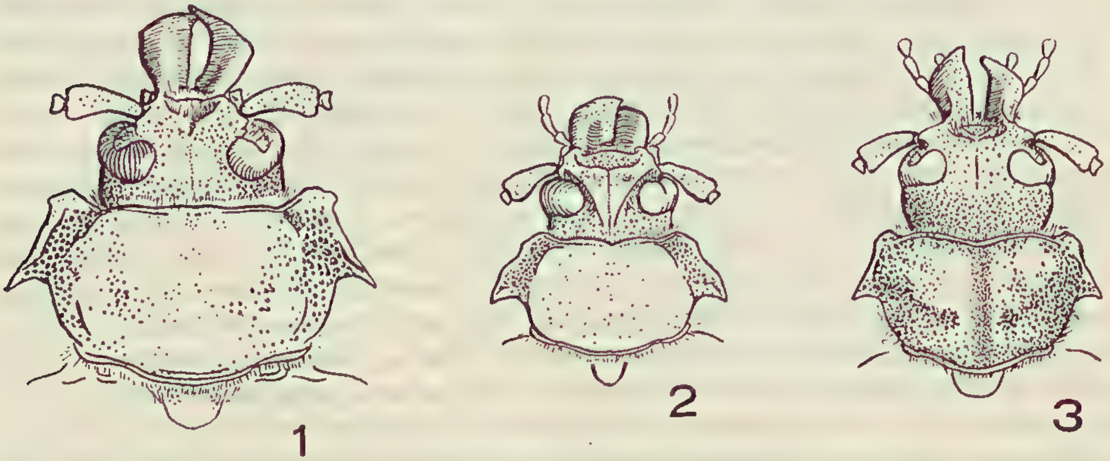


Fig. 1.—*Sceleocantha carteri*, sp. nov., head and thorax. Fig. 2.—*S. cuneata*, sp. nov., head and thorax. Fig. 3.—*S. garnseyi*, sp. nov., head and thorax.

fringed with reddish hair behind; disc smooth and nitid, except for a few small scattered punctures, but becoming coarsely rugoso-punctate at sides. *Scutellum* broadly rounded posteriorly, closely punctate. *Elytra* parallel-sided, narrowly emarginate, scarcely wider than prothorax at its base; shoulders slightly rounded; apex narrowly rounded, produced into a blunt tooth at suture; disc coarsely punctate, punctures larger and sometimes confluent near base, but becoming small on apical fourth; two indistinct and scarcely raised lines on each elytron becoming obsolete within apical fourth. *Under-surface* castaneous; prosternum and sternum densely clothed with long yellowish hairs; abdomen nitid, glabrous with a few small scattered punctures; tibiae with larger and more numerous punctures, spinose on outer edge (*e.g.*, front with two spines, middle with three, hind with three).

Long. 33 mm.; lat. 7 mm.

♂ wanting.

Loc.—"Calumet", 26 miles N.E. of Binnaway, New South Wales (C. F. Garnsey), 14 December, 1933.

Holotype in Australian Museum, Sydney.

This fine species is allied to *S. glabricollis*, but differs from that insect in its strongly developed and rounded head-capsule and its puncturation; the almost complete absence of a median thoracic groove and the straighter line of the sides of the lateral expansions of the prothorax; the coarser puncturation of the elytra, and the shape of the mandibles. The elytral suture of *S. glabricollis* is narrowly emarginate; in *garnseyi* the punctures are continuous to the suture, the only tendency to emargination occurring on apical fourth. Newman's species is also less elongate, and the scutellum tends to be bilobate.

Neouracanthus, gen. nov.

Elongate; elytra parallel, spinose at apex, strongly costate, deeply and regularly punctate between raised costae. Head elongate with a short muzzle; eyes prominent, coarsely granulate. Antennae moderately robust, generally conforming closely to Uracanthoid type, composed of eleven joints, fourth to tenth joints produced obliquely on one side of apex.

Neouracanthus nigroterminatus, sp. nov.

(Plate xxii, fig. 1.)

♂. Slender; orange-brown; the apices of the elytra broadly blue-black, and slightly iridescent, clothed with sparse golden pile; elytra parallel, strongly costate; antennae and legs black. *Head* narrow, produced into a rather short and stout muzzle; finely granulate, median line narrow, well-defined, clypeal suture deep and semicircular; clypeal area markedly convex, nitid, sparsely punctate; mandibles black; eyes prominent, coarsely granulate. *Antennae* longer than body, fourth to tenth joints obliquely produced on one side at apex, and rather flat; joints 3 and 4 of equal length, 5 longer than 4, joints 5–11 approximately equal, pubescent; joint 1 conical, nitid, minutely and sparsely punctate. *Prothorax* distinctly longer than wide, considerably constricted anteriorly; disc with two indistinct tubercles just behind constriction, nodose laterally, the swelling continued on to basal area of disc; posterior area of prothorax finely and closely corrugated; prothorax as a whole irregularly clothed with golden pile, densely on anterior (constricted) third, sparsely behind; anterior and posterior margins squarely truncate. Scutellum small, acutely rounded behind, sparsely punctate, depressed in centre, pilose. *Elytra* slightly broader than prothorax at base, parallel, each with four parallel, raised concolorous costae (exclusive of suture and lateral margin) not reaching apex; area between costae deeply and regularly punctate, becoming irregular on black apical area, which has a somewhat granular appearance; apices bispinose, the exterior spine longer and stouter than that on suture. The whole of the elytra clothed with short, sparse, golden hairs thickest along ridges of costae. *Under-surface*: sternum bright orange-brown, granulate, nitid, pilose between prosternum and sternum; abdomen black, nitid, finely granulate, with a few fine scattered hairs at sides. *Legs* black; femora punctate, nitid; tibiae more coarsely punctate with scattered ashy hairs; hind femora and tibiae more coarsely and closely punctate than anterior pairs.

Long. 19 mm.; lat. 4 mm.

Loc.—Dawson River and Port Denison, Queensland.

♀ similar to male; rather darker in colour; terminal joints of antennae wanting.

Long. 23 mm.; lat. 5 mm.

Holotype ♂ and allotype ♀ in Australian Museum, Sydney.

This striking species conforms closely to *Uracanthus* in many of its characters, but its appearance is wholly unlike any species of that genus, its strongly costate and deeply punctate elytra, together with the blue-black elytral apices, rendering it very distinct. In view of those characters it has been considered desirable to erect a new genus for its reception.

The elytral sculpture is very similar to that found in members of the genus *Syllitus*, to which species it also bears some resemblance in the shape of the prothorax; the elytra and antennae, however, apart from other characters, show its affinity with the Uracanthini.

Genus Macrones Newman, 1841.

Macrones brandoni, sp. nov.

(Plate xxiii, fig. 5; figs. 5, 5*a*.)

Elongate; slender; dark ferruginous clouded with black. *Head* dark ferruginous, narrow, elongate, produced into a blunt muzzle, cheeks not swollen, parallel; base of head swollen, convex, strongly nitid, irregularly punctate, punctures large, with conspicuous glabrous nitid areas between them; a depressed transverse area behind the eyes finely and diagonally corrugated; a deep, well-defined median line extending from just in front of swollen base to between antennary tubercles, wide and nitid posteriorly; frons corrugated, with interspersed punctures, semi-nitid; antennary tubercles small, nitid; eyes small, finely granulate. *Antennae* reaching to apex of elytra, black, apical joints bright ferruginous; joint 1 elongate, clavate, nitid, punctate on apex, with a few scattered coarse black hairs; joints 2–6 black, pubescent, 7–8 black clouded with ferruginous; joints 9–11 bright ferruginous. *Thorax* dark ferruginous clouded with black, considerably longer than wide, divided into three clearly differentiated transverse areas: (1) an anterior smooth constricted area, lightly tuberculate laterally; this area is almost flat in profile; (2) a strongly elevated rugose area, longitudinally deeply and widely sulcate, laterally strongly and acutely tuberculate, there being two tubercles situated one above the other, so that when viewed from above the lower is almost concealed; anterior and posterior borders sinuate, posterior border blackish; (3) a smooth constricted posterior area. *Scutellum* sub-triangular, smooth, concave. *Elytra* very slightly wider than thorax at base, laterally incurved, tapering sharply to apex, not reaching extremity of abdomen, apices acutely rounded; base and shoulders coarsely punctate, giving a rugose appearance, suture concolorous over basal two-thirds, but gradually becoming black; lateral margin light ferruginous over basal fourth, then black; two almost parallel raised and coarsely punctate costae on each elytron; subsutural costa brown merging into black towards apex, second costa obsolete at shoulder, concolorous on basal fourth, then black, subsutural costa shorter than second; area between second costa and lateral margin coarsely punctate, black over apical three-fourths; areas between suture, subsutural and second costa smooth, semi-nitid. *Abdomen* brown, elongate, clavate, narrowly margined laterally, finely and closely punctate, sparsely clothed with scattered reddish hairs seated in punctures, apical half of last segment red, lightly fringed with black hairs. *Legs*: Forelegs: femora clavate, with scattered punctures, ferruginous; tibiae black, becoming slightly reddish at joints, tarsi black, fringed with yellow hairs. Middle legs: femora clavate, ferruginous, punctate; tibiae black; tarsi black. Hind legs: femora clavate, punctate, basal two-thirds blue-black, apical third bright ferruginous-yellow. *Under-surface* uniform dark ferruginous, abdomen glabrous, subnitid.

Long. 30 mm.; lat. 4·5 mm. (at shoulders).

Loc.—Tuross River, New South Wales (Dr. A. J. Spiller Brandon and K. C. McKeown).

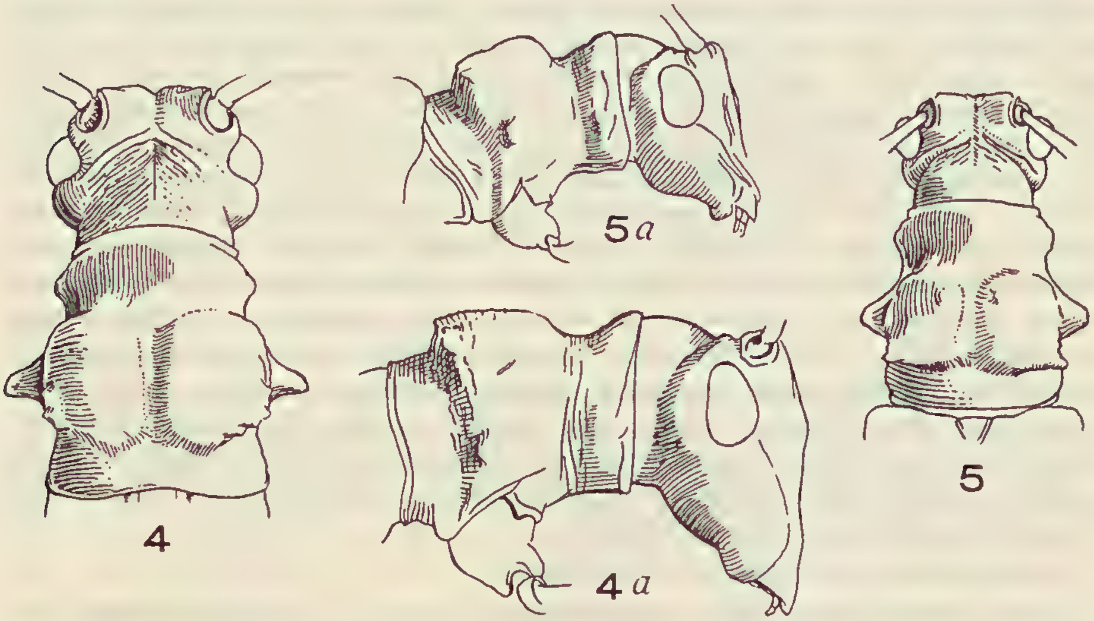
Holotype in Australian Museum, Sydney.

This striking species bears a somewhat close general resemblance to *M. rufus* Saunders, but may be readily distinguished from that species by the shape of the anterior constricted portion of the prothorax, which is almost flat in profile (figs. 5, 5*a*), while that of *rufus* (figs. 4, 4*a*) is excavated into a deep, rounded, transverse channel or groove. The colour of antennae, legs, elytra, etc., also serves to separate the species. These insects were taken on the Tuross River clinging to the smooth bark of eucalypts on dull misty days during January and March, 1936. I have dedicated this species to my friend, the late Dr. A. J. Spiller Brandon.

Macrones purpureipes, ~~sp. nov.~~ L-00

(Plate xxiii, fig. 2.)

Elongate; purplish black. *Head* narrow, produced into a stout muzzle; median line strongly developed; base of head black, sparsely punctate, diagonally corrugated on each side of median line; coarsely punctate and transversely corrugated towards clypeal suture; clypeal suture deep, sharply angulate; clypeal area convex, coarsely punctate; muzzle rufous clouded with black, coarsely punctate; eyes large, prominent, coarsely granulate; antennary tubercles rufous, tipped with black. *Antennae* considerably shorter than body, black with a slight purplish tint when viewed from certain angles, finely and closely punctate, with a few scattered black hairs; first joint elongate, narrowly clavate, sparsely and minutely punctate, more closely subapically, extreme apex very nitid; subapical joints closely and finely punctate with a band of stiff black hairs at apex; apical joint small, conical. *Thorax* as long as broad, divided into three distinct areas, being constricted both anteriorly and posteriorly, with the central portion strongly swollen, rufous with purplish-black tints; anterior constricted area bluntly tuberculate laterally; tumid area coarsely corrugated, with three large tubercles on either side of hind margin, lateral tubercles most strongly produced, median somewhat obsolete. *Scutellum* grey, subtriangular, rugose. *Elytra* slightly wider than prothorax at base, laterally incurved, tapering sharply to apex, not reaching extremity of abdomen, sparsely and minutely punctate, dingy cream colour towards base, but becoming smoky-brown on apical two-thirds; shoulders brown; suture, lateral margin, and two raised, coarsely punctate costae coalescing before apex, on each elytron, brown; apices acute, hollowed above. *Legs* black with a purplish lustre, finely punctate; fore and middle tarsi dark brown, hind tarsi bright yellow. Abdomen clavate, purplish-black, strongly emarginate laterally, sides brownish. *Under-surface* dark brown, coarsely and closely punctate, glabrous, apices of abdominal segments black, nitid.



Figs. 4 and 4*a*.—*Macrones rufus* Saund., dorsal and lateral view. Figs. 5 and 5*a*.—*M. brandoni*, sp. nov., dorsal and lateral view.

Long. 28 mm.; lat. 4 mm. (at shoulders).

Loc.—Coorong, South Australia (F. Wood Jones); South Australia (Rev. A. P. Burgess.

Holotype in Australian Museum, Sydney.

This very striking species occurs in several collections under Lea's manuscript name of *purpureipes*, and this name is now validated here. The insect somewhat resembles an exceptionally large *besti* Newm., but is readily distinguished from that insect by its tuberculate prothorax, the coloration of the head and muzzle, legs, etc.

Genus **Aridaeus** Thomson, 1860.

Aridaeus cleroides, sp. nov.

(Plate xxii, fig. 3.)

Rather slender; a narrow somewhat L-shaped line on each elytron white; antennae dull red; legs black.

♀. *Head* as in *A. thoracicus* Don.; glabrous, base finely granulate, black behind a line joining the eyes; frons coarsely punctate, with a short median line, red clouded with black between antennary tubercles; clypeal suture wide, deep, and broadly curved; clypeal area red, coarsely punctate; mandibles red tipped with black. *Antennae* almost as long as body, slender and of more or less uniform thickness, sparsely pubescent, with a few scattered stout, erect hairs; relative proportions of joints as in *A. thoracicus*. *Prothorax* black; broadly rounded, strongly constricted at base; disc granulate, with long scattered erect hairs, thickest on margins, with two rather laterally placed rounded patches of velvety pile of a deeper tint than derm; no median line. *Scutellum* triangular, sparsely pubescent. *Elytra* straight-sided, parallel, slightly wider at shoulders than prothorax at widest point; angles of shoulders obtuse; apices widely rounded, divergent at suture; black, except for a narrow, rather L-shaped, curved line (reversed on left elytron) of dense silvery-white pile about the middle; this line at first runs parallel with the elytral suture, then bends sharply and crosses the elytron, reaching the lateral margin, becoming slightly broader at point of contact; surface closely pubescent; behind the white line the pubescence is recumbent and mixed with longer whitish hairs which give the effect of a somewhat silvery lustre; the apical area is more sparsely pubescent and semi-nitid, the exposed derm being sparsely punctate, with slender hairs arising from the punctures. *Legs* very long; femora not markedly thickened; front tibiae, front, middle and hind tarsi dull reddish; hind tibiae armed with two long slender spines at apex. *Under-surface* black, nitid, with a silvery pubescent area on first abdominal segment extending to lateral margin of elytra; apical abdominal segments with sparse white hairs.

Long. 15 mm.; lat. 4 mm.

♂ similar to ♀, smaller, antennae longer than body.

Long. 11 mm.; lat. 3·5 mm.

Loc.—Williams River, New South Wales.

Holotype ♀ and allotype ♂ in Australian Museum, Sydney.

This remarkable species is unlike any other described in the genus, and is readily distinguished by its black coloration, the white marking on the elytra, and red antennae.

The insect bears a remarkably strong resemblance to the Clerids of the genera *Trogodendron* and *Scrobiger*, insects which in their larval and adult stages are predaceous on Cerambycid larvae. *A. cleroides* is very similar in both shape and colour, and the resemblance is enhanced by the red antennae.

Genus **Brachytria** Newman, 1840.

Brachytria discopunctata, sp. nov.

(Plate xxii, fig. 4.)

Slender; black; head red; a wide cream-coloured transverse fascia on elytra. *Head* sparsely and coarsely punctate, semi-nitid, a few coarse hairs on frons.

Antennae considerably longer than body, black, closely pubescent, with a few stout erect hairs on basal joints. *Prothorax* black, sides slightly and evenly rounded, longer than broad, very coarsely and confluently punctate, with a raised impunctate median ridge widening strongly posteriorly. *Elytra* wider than thorax, nitid, narrowly blueish-black at base and shoulders; a wide irregular transverse fascia of cream or pale yellow extending across elytra, but not quite reaching lateral margin, which is narrowly blue-black; apical half blue-black with a somewhat metallic lustre; two broad raised costae on each elytron, interspaces coarsely and closely punctate, giving a reticulate appearance; sparse erect hairs seated in punctures; apices of elytra obliquely truncate, irregularly emarginate, narrowly tipped with yellow and with a short tuft of black hairs. *Legs* black.

Long. 9 mm.; lat. 3 mm.

Loc.—Wide Bay, Queensland.

Holotype in Australian Museum, Sydney.

This species bears a superficial resemblance to *Brachytria centralis* Pascoe, with which it has been confused in some collections. It is, however, readily separated by its black, coarsely punctate (almost rugose) prothorax, with its longitudinal raised and impunctate median line. The specimens before me, judging by the length of the antennae, appear to be males.

Brachytria angulata, sp. nov.

(Plate xxii, fig. 2.)

Slender; black; head and thorax red; a broad, irregular cream fascia across elytra; antennae and legs black. *Head* rather narrow, glabrous, nitid, with large, shallow, scattered punctures, a few stout erect black hairs at base and around mandibles; mandibles red tipped with black; eyes black, finely granulate; antennary tubercles almost obsolete. *Antennae* shorter than body; first joint curved, slightly clavate, sparsely punctate, semi-nitid, with sparse, stout black hairs on sides; joint 5 as long as 6, finely punctate, semi-nitid with scattered black hairs; 6–10 produced at apex on exterior, clothed with ashy pubescence, a stout erect bristle on inside at apex; terminal joint rather broadly rounded at apex, clothed with ashy pubescence. *Prothorax* markedly convex, strongly nitid, with a few large, shallow and widely spaced punctures; strongly emarginate laterally, emargination produced into a stout, broadly acute angle, minutely tipped with black; anterior margin constricted, straight; posterior margin constricted, depressed, with coarse punctures, sinuate, lightly emarginate, with an acute semi-erect, posteriorly directed, lateral tubercle; disc with two large, roughly rounded black spots, sparsely clothed with scattered, stout, erect, black hairs, more numerous towards lateral margins. *Scutellum* elongate, triangular, yellow margined with black. *Elytra* broader than prothorax at base, shoulders prominent; each elytron with four raised longitudinal costae, the sutural slightly elevated, the second or subsutural arising from edge of basal black area and becoming stronger as it proceeds towards apex, but terminating before apex, the third arising from shoulder, strong, as long as second, a strong double costa forming lateral margin, black throughout its length; apices of elytra obliquely sinuate-truncate, broadly emarginate; basal area black, an irregular transverse cream fascia extending to lateral marginal costa, apical half brownish-black, tending to black on anterior edge; basal black area deeply and coarsely punctate, the punctures, especially towards lateral declivity, frequently confluent, strongly nitid; cream area semi-nitid, sparsely and irregularly punctate; apical dark area regularly and rather coarsely punctate, the punctures not as large as on basal area, not confluent, nitid. The whole surface of the elytra with scattered, stout, erect hairs, each hair black at base, but becoming ashy towards tip. *Under-surface*: head and prothorax red, sternum and abdomen black, first segment of abdomen reddish, clothed with ashy hairs. *Legs* black, nitid, with scattered erect ashy hairs.

Long. 16 mm.; lat. 4 mm.

Loc.—King George's Sound, West Australia.

Holotype in Australian Museum, Sydney.

This species most closely resembles *B. picta* Waterh., but is very readily separated by the strongly emarginate and angulate prothorax, the sparsely punctate elytral fascia, etc.

Brachytria occidentalis, sp. nov.

(Plate xxiii, fig. 3.)

Slender; blue-black; head and prothorax red; an irregular dusky cream fascia across elytra; legs and antennae black. *Head* glabrous, nitid, slightly tumid at base, coarsely and sparsely punctate, punctures most numerous on clypeus and between antennary tubercles; antennary tubercles small, slender; a narrow, deeply depressed median line between antennary tubercles; eyes black, finely granulate, superior lobes very narrow and widely separated from bases of antennae; mandibles red minutely tipped with black; palpi brown. *Antennae* shorter than body; first joint somewhat clavate, sparsely and irregularly punctate, nitid; joints 2–4 short, nitid, sparsely punctate, with scattered erect black hairs; joint 6 longer than 5; joints 6–10 about same length, slender, slightly produced on exterior of apex; joint 11 slightly shorter, broadening towards apex; joints 10–11 slightly flattened; joints 5–11 clothed with a short brownish pubescence. *Prothorax* glabrous, nitid, sides broadly and evenly rounded to a slight lateral angle, then constricted sharply to base, not emarginate; anterior and posterior margins straight, narrowly emarginate; disc slightly bituberculate, tubercles low and smooth, little produced above surface; slightly swollen medially at base; disc with two faint brownish spots; evenly and sparsely clothed with erect black hairs, most numerous towards sides. *Scutellum* narrow, elongate, concave, strongly emarginate, brown edged with black. *Elytra* wider than prothorax at base, parallel, slightly constricted behind shoulders, shoulders rounded; apices of elytra obliquely truncate, bluntly angulate at suture, narrowly emarginate; each elytron with five raised, impunctate, roughly parallel costae; sutural costa strong; subsutural costa weakly developed, arising from posterior margin of black basal area, somewhat divergent on basal half, but approaching and running parallel to suture on apical half, ending well before apex; third costa rising near shoulder, somewhat obscured by punctures on basal fourth, but becoming well defined and strongly raised over remainder, not quite reaching apex, longer than second; fourth rising on shoulder, very strong and well defined, very slightly shorter than third; lateral margin formed by a single strong costa, black throughout its length; basal area of elytra narrowly blue-black, with an elongate extension between costae 3 and 4 to about one-fourth of length; a very irregular dusky cream fascia across elytra reaching to lateral costa, extending at suture from apex of scutellum to about half length; apical half brownish-black; the whole of the elytra coarsely and confluently punctate, punctures becoming smaller and more regular over apical half; sparsely clothed with erect black hairs, thickest along lateral margins and apices. *Legs* black, nitid, sparsely punctate, rather densely clothed with erect black hairs; hind femora slender, elongate-clavate. *Undersurface*: head and prothorax red; sternum black, finely punctate; basal segment of abdomen wholly orange-yellow, second orange-yellow clouded with black, remaining segments blue-black, nitid, with a few small scattered punctures, very sparsely clothed with fine black hairs towards apex.

Long. 16 mm.; lat. 4 mm.

Loc.—King George's Sound, Western Australia.

Holotype in Australian Museum, Sydney.

Somewhat resembles the preceding species, but is readily separated by the non-emarginate prothorax, the unbroken elytral puncturation, costae, etc.

Genus **Somatidia** Thomson, 1862.

Somatidia nitida, sp. nov.

Robust; dark stramineous; head and thorax dark castaneous; glabrous, nitid; elytron with a somewhat irregular dark area at apical fourth; antennae and legs light stramineous, antennae with apices of joints black with the exception of basal and apical two. *Head* small, closely and finely punctate; eyes coarsely granulate. *Antennae* slightly longer than body. *Prothorax* convex, oval, sides broadly and evenly rounded, an emarginate blunt prominence at hind lateral angle, semi-nitid, disc coarsely and closely punctate. *Elytra* nitid, evenly convex without elevated or depressed areas, somewhat ovate, narrowing to a bluntly pointed apex; basal three-fourths with rows of large and deep punctures; two rows parallel with and close to suture, separated by an impunctate area of about the same width from a further punctate area extending to lateral margin, the punctures becoming smaller and closer on lateral declivity; apical fourth smooth, extremely nitid, with a few large punctures continuing the line of certain of the basal rows; area behind black mark darker than colour of basal area. *Legs*: femora broadly clavate with sparse black hairs.

Long. 3 mm. (–).

Loc.—Tweed River, New South Wales (W. W. Froggatt, 1903).

Holotype in Australian Museum, Sydney.

This is the second species of *Somatidia* to be described from the mainland of Australia. The insect under review is close to Mr. H. J. Carter's species, *S. australiae*, but differs from it by the complete absence of pubescence, the absence of erect hairs upon head and prothorax, and its entirely nitid appearance. The elytra are so glossy as to give the insect an almost metallic lustre when viewed from certain angles, especially on lateral fourth.

Genus Zygocera Erichson, 1857.

Zygocera norfolkensis, sp. nov.

(Plate xxiii, fig. 1.)

Robust; brownish-black, glabrous, nitid. *Head* narrow, minutely and closely punctate; an impressed median line, deepest between antennary tubercles; antennary tubercles prominent, almost contiguous, divided by a deep fissure. *Antennae* longer than body; joint 1 cylindrical, closely punctate, nitid, lightly fringed beneath with black hair; joints 2–11 minutely punctate, sparsely pubescent; pubescence on joints 3 and 9–11 concolorous, on 4–8 pale ashy; joint 3 considerably longer than 4, 4 longer than 5, with each succeeding joint being apparently a little longer than that preceding it. *Thorax* subquadrate, nitid, slightly rugose, with a blunt, somewhat bifid, nitid median tubercle close to posterior border; acutely spined laterally; a transverse ridge connecting lateral spines bearing numerous small nitid tubercles; anterior and posterior margins truncate, lightly emarginate. *Elytra* wider than prothorax at base; shoulders produced into rounded tubercles; a large acute tubercle, directed forwards and projecting beyond basal line of elytra, situated between shoulder and scutellum; basal area with numerous small pustular tubercles; elytral apices bispinose; each elytron with two raised lines, the first close to and parallel with suture, the second about 1 mm. from and parallel to first; the subsutural line continuous with sutural spine of elytral apex, the second broken and displaced laterally about 1 mm. from tip of lateral spine; between the raised lines the elytron is pitted with an irregular double row of large shallow punctures, those near base with a small pustule on upper edge, the remainder of elytron irregularly pitted with similar but simple punctures; elytra with a very narrow lateral emargination. A very slight ashy pile is present along the elytral ridges, and there is a small pilose ashy spot at apical third. *Scutellum* narrower than long, rounded behind, finely punctate, nitid, and strongly convex. *Legs* black; femora sparsely and finely punctate, with a few scattered ashy hairs; tibiae sparsely punctate, upper two-thirds with scattered short white hairs, lower third densely clothed with stout black hairs; tarsi with sparse ashy hair above, and closely fringed with black hairs tipped with buff; beneath with yellow hair. *Under-surface* nitid, glabrous, sternum lightly pilose towards sides.

Long. 16 mm.; lat. 6 mm.

Loc.—Norfolk Island.

Holotype in Australian Museum, Sydney.

Unlike any of its allies, this species is readily distinguished by its nitid and shallowly punctate elytra.

Zygocera maculata, sp. nov.

(Plate xxii, fig. 6.)

Elongate; black, nitid, spotted with white. *Head* with frons lightly margined with white pile, a while line behind each eye; cheeks sparsely pubescent; antennary tubercles prominent. *Antennae* pitchy, with a sparse fringe of coarse black hairs beneath; terminal joints wanting. *Thorax* broader at base than apex, irregularly sprinkled with small patches of white pubescence interspersed with long scattered black setae, each arising from a puncture; disc with three small nitid tubercles placed transversely; sparsely and deeply punctate towards anterior border, which is truncate, lightly emarginate, with a narrow border of white hairs; a small lateral thoracic spine is almost concealed by a patch of dense white pubescence; posterior margin lightly sinuate, narrowly emarginate, with a thin line of white hairs just before emargination. *Scutellum* narrow, concave, sharply rounded posteriorly, lightly margined with buffy-white pile. *Elytra* broad, depressed and projecting at shoulders, wider than base of thorax, but tapering markedly towards apex; each elytron with a large, strongly elevated, nitid, basal tubercle; coarsely and irregularly punctate on basal third, punctures smaller on middle third, with a raised, strongly nitid, raised line parallel to suture, almost impunctate on apical third; apex truncate from suture with a prominent, blunt, lateral spine. The elytra are sparsely and irregularly sprinkled with small patches of buffy-white pile, becoming larger and coalescing irregularly on posterior margin of basal third, and again, though more diffuse, on hind margin of basal two-thirds; in addition to the pilose patches there are numerous scattered setae, each seated in a puncture, the setae longer and stouter on the basal area. *Under-surface* black; prosternum and sternum sparsely and irregularly clothed with buffy-white pile; abdomen nitid, very closely and minutely punctate, with a pilose lateral patch on each segment. *Legs* black, with a mixed grey and black pubescence; tarsi with buff hairs.

Long. 13 mm.; lat. 5 mm. (at shoulders).

Loc.—Byfield, near Yeppoon, Queensland (C. E. Sims).

Type (unique) in Australian Museum, Sydney.

This species bears a close superficial resemblance to *Z. pruinosa* Bois., but is readily distinguished by the spinose elytral apices, and the absence of the transverse white line on the centre of elytra.

Genus **Rhytiphora** Serville, 1835.

Rhytiphora browni, sp. nov.

(Plate xxiii, fig. 4.)

Moderately robust; black, densely clothed with shining silvery-white and ochreous pubescence of a satiny texture, ornamented with brownish-black glabrous areas; the elytra conspicuously striped.

♀. *Head* medium, somewhat closely and coarsely punctate, with a narrow continuous median line. *Antennae* reaching almost to extremity of body. *Prothorax* longer than wide, without transverse folding. *Elytra* broadest at shoulders, with the sides from thence gradually diminishing in width to apex, where each is acutely bispinose. The suture with a line of small scattered, black, nitid tubercles along anterior third; glabrous black areas of elytral stripes with an irregular line of large and frequently confluent punctures; the pilose areas between second and fourth black stripes irregularly punctate, but more or less obscured by the clothing of pilosity; lateral margin slightly ridged, smooth.

Long. 27 mm.; lat. 8 mm.

Loc.—Cue, Western Australia (H. W. Brown).

♂. Slender; similar to female; antennae longer than body; pubescent abdominal depressions entirely absent.

Long. 21 mm.; lat. 6 mm.

The head, around the eyes, cheeks, and the median stripes clothed with silvery pubescence. The pubescence on the prothorax is silvery-white, but tinged with ochraceous towards the posterior margin, and is crossed by four transverse glabrous lines, the anterior not interrupted in the middle, the second not extending over the lateral areas and formed of two lunular lines meeting on the median line, the third not extending over lateral areas and interrupted on the median line, the fourth forming a narrow line along the posterior margin of thorax. In some specimens the anterior and posterior lines are obscured by silvery pubescence. The scutellum is black, glabrous in the centre, and margined laterally with ochreous pile. On the elytron the stripes are as follow: an extremely narrow sutural stripe ochraceous on anterior third and becoming silvery on posterior two-thirds, a narrow black stripe (1) reaching to apex, a wide silvery stripe, a narrow black stripe (2) terminating about apical fifth, a narrow silvery stripe stained with ochraceous, a narrow black stripe (3) conjoined—more or less—with fourth black stripe a little before apex, a narrow silvery and ochraceous stripe, a narrow black stripe conjoined with third and reaching to apex, a broad silvery stripe reaching to lateral margin, with a very short and narrow black line on lateral margin along apical tenth. Under-surface heavily clothed with dense silvery pile, with an irregularly shaped brownish-black glabrous area with scattered small patches of silvery pubescence laterally on each of the abdominal segments, with the exception of apical one, which may bear a few small and scattered glabrous spots. Sternum white, silvery; episterna black, tinged and lightly margined with ochraceous. Antennae black, almost glabrous, thickly fringed beneath with long black hairs, thickest on second and third joints, becoming more sparse towards apex. Legs almost uniformly clothed with silvery pubescence; tarsi sparsely clothed with silver hairs; claws black.

This very fine and striking species has remained undescribed for a long while, possibly owing to the fact that it is present in some collections under the manuscript name of *R. browni*—a name which has been retained here. It is allied to *R. dallasi*, but may be distinguished from that species by its bispinose elytral apices, the fact that the second, third and fourth black stripes are separated only by very narrow pale areas, and by the absence of the narrow black lateral marginal line. These differences are constant throughout a large series of specimens.

Genus **Penthea** Castelneau, 1840.

Penthea adamsae, sp. nov.

(Plate xxii, fig. 5.)

Robust; black, clothed with a dense pile of varied buff and light fawn. *Head* broad, densely clothed with shaggy yellowish-buff hairs varied with small black spots and interspersed with long erect black hairs; eyes small, finely granulate, anterior lobe transverse, cheeks swollen; indications of a faint impressed median line; antennary tubercles small, transverse. *Antennae* shorter than body; first joint cylindrical, clothed with dense yellow-buff pile and thickly sprinkled with long erect black hairs; joint 3 longer than 4, 4 slightly longer than 5, 6–10 approximately of the same length, apical joint bluntly pointed; joints 2–11 clothed with a short, close, black pile; joints 2–5 lightly banded with buff at joints; beneath sparsely fringed with long black hairs, a few of which project stiffly at joints. *Prothorax* broader than long, narrower before than behind, strongly convex, sides rounded, with a minute spine or tooth laterally situated; a fine impressed median line; densely clothed with close, varied buff and light fawn pile interspersed with long, scattered, erect black hairs, and varied with numerous black spots produced by small patches of naked black derm showing through the overlying covering; this derm is irregularly punctate, being interspersed with large, shallow, rounded punctures, while the interspaces are closely and minutely punctate. *Scutellum* broad, rounded, and thickly covered with long orange-buff pile. *Elytra* broader than prothorax at shoulders, tapering broadly to apex; apices produced into a blunt point; clothed with a dense pile of mixed buff and light fawn interspersed with long erect black hairs and varied with numerous small black spots, produced, as on the prothorax, by the naked black derm showing through the overlying pile; derm with large shallow, pit-like punctures, while the interspaces are very minutely and closely punctate and have a shagreened appearance; the patches of light fawn pile tend to be slightly larger and more numerous towards the lateral areas of the elytra. *Legs* stout, wholly covered with long pale-buff pile intermixed with stiff silvery bristles, and marked with minute black spots. *Under-surface* wholly clothed with loose yellow-buff hair-like pile.

Long. 14 mm.; lat. 6 mm.

Loc.—Rockhampton, Queensland.

Holotype in Australian Museum, Sydney.

This beautiful little insect, with its rich 'pepper and salt' coloration, is entirely unlike any of the described species of *Penthea*, and is at once readily distinguished from all of them by its small size, robust form, and its dense clothing of short pile, finely sprinkled with buff, fawn, and black.

I have named this insect in honour of Miss N. B. Adams, Assistant, Department of Entomology, Australian Museum, as a small tribute to her beautiful drawings of entomological subjects, which add so greatly to the value of my papers.

Genus **Uracanthus** Hope, 1833.

Uracanthus leai, nom. nov.

Uracanthus leai, nom. nov., for *Uracanthus inermis* Lea, 1917.

1917. *Uracanthus inermis* Lea, Proc. Linn. Soc. N.S. Wales, xli, 4, 1916 (4 April, 1917), p. 738.

The name of *Uracanthus leai* is proposed for *Uracanthus inermis* Lea, nom. praeoc. Aurivillius described a species from New South Wales under the name of *Uracanthus inermis* in the *Arkiv f. Zoologie*, x, 4, 23, 30 January, 1917, p. 16, note, while Lea's species of the same name was not published until 4 April of the same year. The locality for this insect is given as Cairns, Endeavour River, Queensland.

Genus **Nenenia** Pascoe, 1886.

Nenenia fasciata (Gahan).

1893. *Phlyctaenodes fasciatus* Gahan, Trans. Ent. Soc. Lond., p. 179.

An examination of a large series of specimens, all of which agree in every respect with Gahan's description of *Phlyctaenodes fasciatus*, definitely establishes the fact that the insect is a member of the genus *Nenenia*, and its position and synonymy are now as given above. All the specimens examined are from Hobart, Tasmania, the type locality, where they were originally taken by Walker.

Nenenia fasciata (Gahan) resembles *N. thoracica* Blkb., but differs from that species by its black and opaque prothorax; the elytra are crossed by a similar narrow yellow band a short distance in front of the apex; the coloration of the elytra is very similar, the metallic tint of *fasciata* being, perhaps, greener. Some specimens of *fasciata*, possibly immature, have a rather brownish tint. Gahan's description of *fasciata* is quite adequate.

Genus Distichocera Kirby, 1818.

Distichocera superba v.d. Poll.

1887. *Distichocera superba* Poll, Notes Leyden Museum, ix, p. 113. ♀.

1894. *Distichocera frenchi* Blkb., Proc. Linn. Soc. N.S. Wales, viii (2), p. 200. ♂.

Distichocera superba Poll and *D. frenchi* Blkb. are the sexes of the same species, and the synonymy must stand as above.

D. superba was originally described from a unique female from the Clarence River, New South Wales, and *frenchi* from a unique male from N. Queensland, collected by C. French. The Australian Museum collection contains specimens from the following localities: Cape York, ♂♂, ♀♀; N. Queensland, ♀♀; Brisbane, Queensland, ♀♀; Richmond River, New South Wales (R. Etheridge), ♀; and Dorrigo, New South Wales (J. Davidson), ♂.

Genus Tragocerus Latreille, 1829.

Tragocerus fasciatus Donovan.

1805. *Prionus fasciatus* Don., Ins. New Holland, t. 6, fig. 3 (col.) [♀].

1805. *Prionus bidentatus* Don., Ins. New Holland, t. 6, fig. 4 (col.) [♂].

1835. *Tragocerus australis* Boisd., Voy. Astrolabe, Ins. ii, p. 465; Atlas, t. 8, fig. 6 (col.) [♀].

Aurivillius, in the Junk Catalogue, pars. 39 (28 February, 1912), p. 487, queries the possibility of *T. fasciatus* and *bidentatus* being identical ("*fasciatus* = *bidentatus* ?"), but lists them separately. As the result of the study of a very large series of specimens, I have no doubt that they are the sexes of but one species, the synonymy of which should now stand as above. Examination reveals that all the specimens of *bidentatus* are males, while all those of *fasciatus* are females. Similar sexual differentiation of the elytral apices exists in *T. lepidopterus* Schr., the apices of the female being truncate and of the male bidentate. Both sexes are variable in size, the variation in the females being exceptionally marked; the males range from 16 mm. to 24 mm. in length, the females from 16 mm. to 37 mm.

A single example of what appears to be *fasciatus* var. *bifasciatus* Guér., from Western Australia, is a male.

Specimens in the Australian Museum collection are from the following localities: ♂♂ Sydney, Killara, Dobroyd and La Perouse (the latter three localities are near Sydney); ♀♀ Sydney, and Sutherland near Sydney.

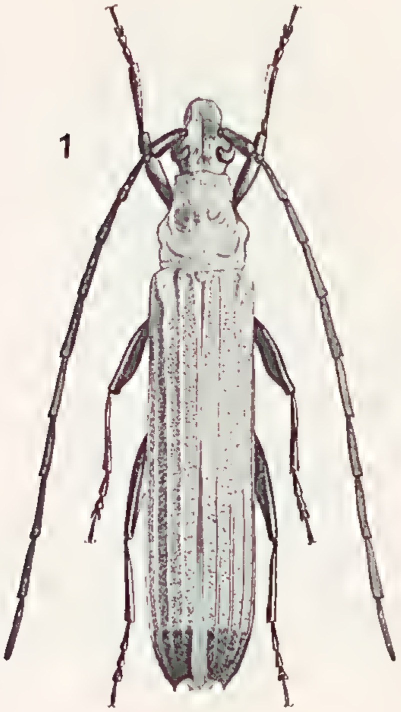
EXPLANATION OF PLATES.

PLATE XXII.

Fig. 1.—*Neouracanthus nigroterminatus*, sp. nov.
Fig. 2.—*Brachytria angulata*, sp. nov.
Fig. 3.—*Aridaeus cleroides*, sp. nov.
Fig. 4.—*Brachytria discopunctata*, sp. nov.
Fig. 5.—*Penthea adamsae*, sp. nov.
Fig. 6.—*Zygocera maculata*, sp. nov.

PLATE XXIII.

Fig. 1.—*Zygocera norfolkensis*, sp. nov.
Fig. 2.—*Macrones purpureipes*, sp. nov.
Fig. 3.—*Brachytria occidentalis*, sp. nov.
Fig. 4.—*Rhytiphora browni*, sp. nov.
Fig. 5.—*Macrones brandoni*, sp. nov.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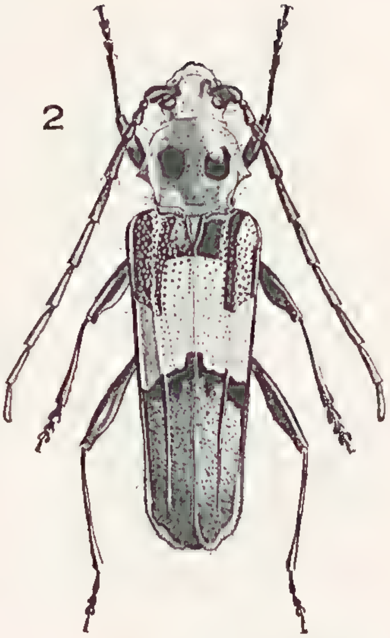
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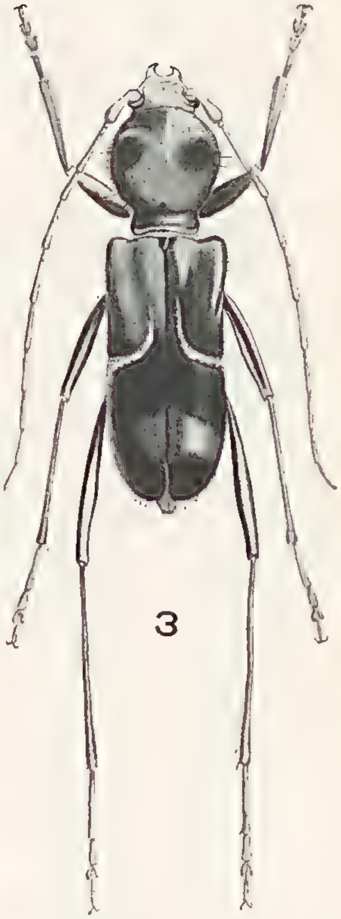
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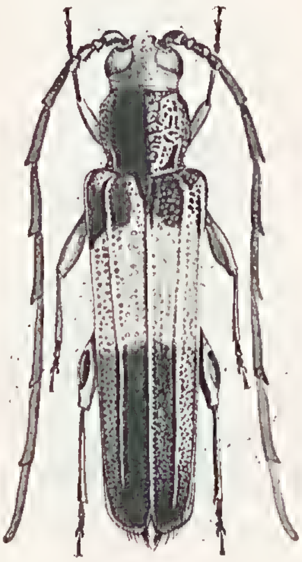
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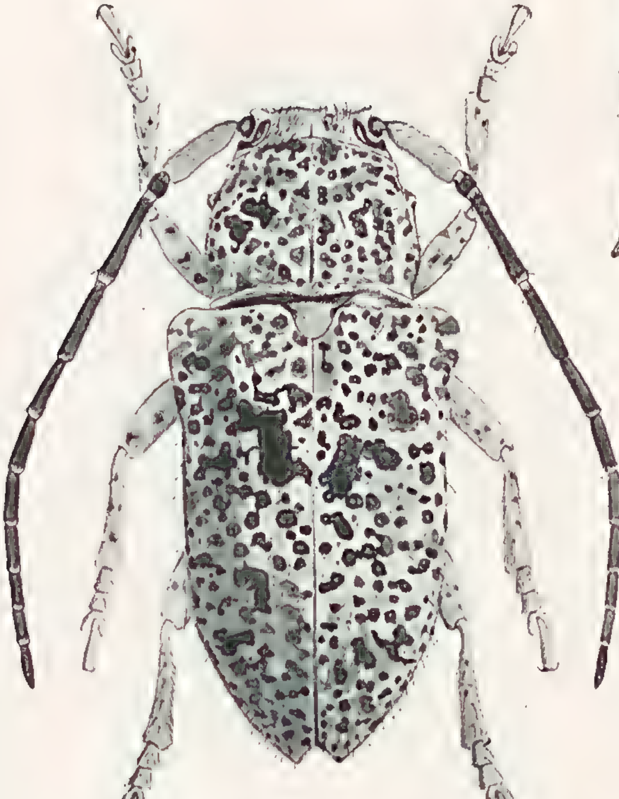
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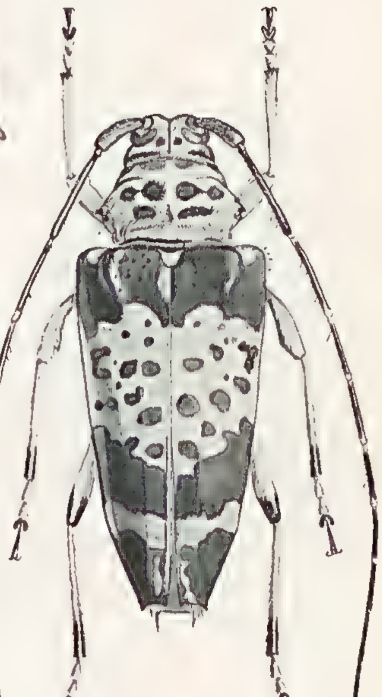
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NANCY B. ADAMS, *del.*

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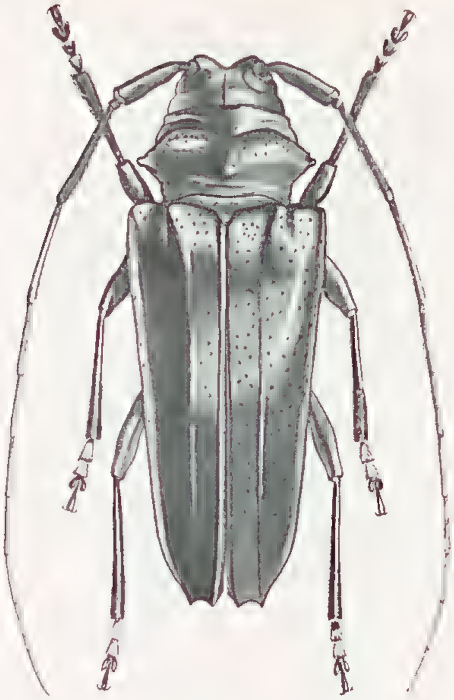

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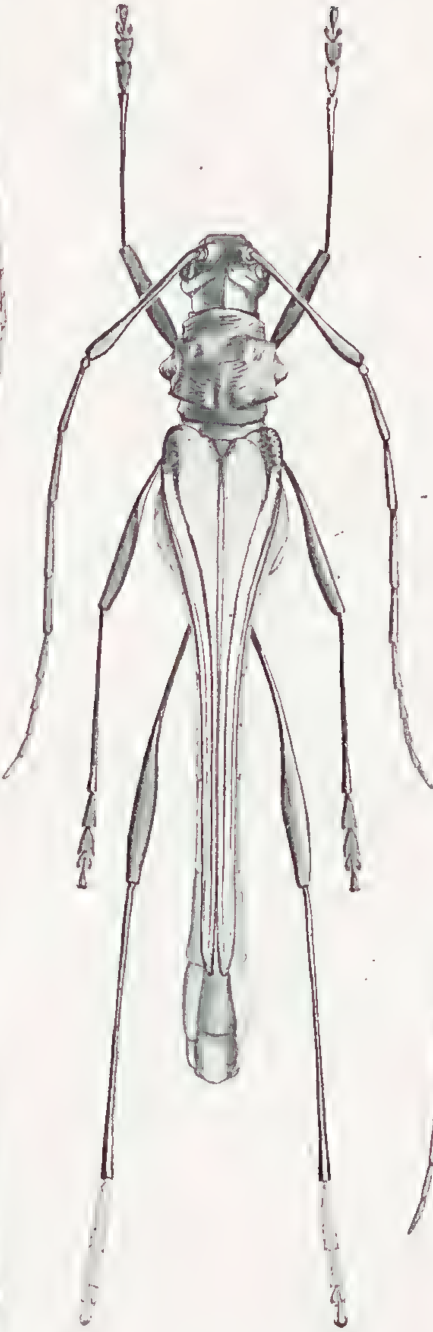

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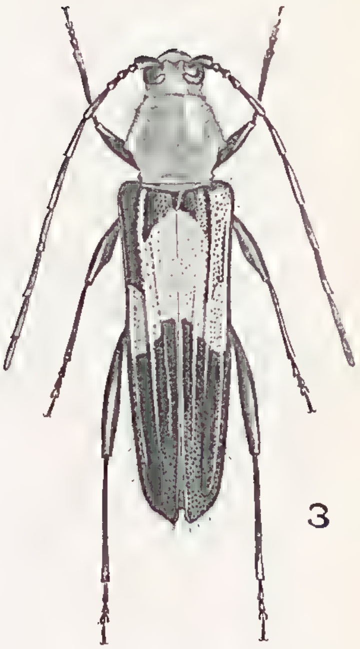

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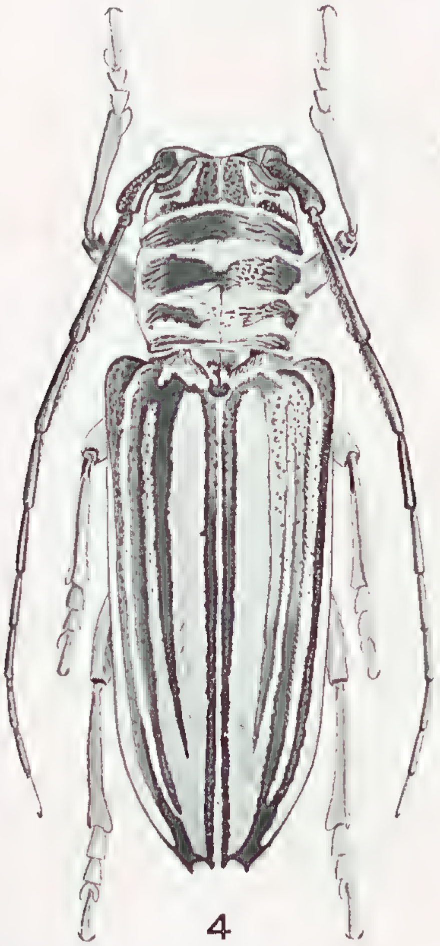

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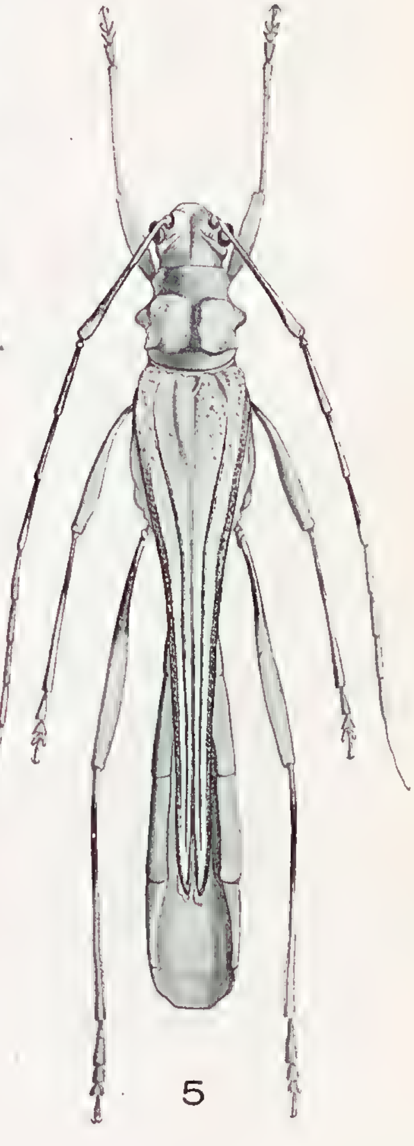

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NANCY B. ADAMS, *del.*

NATIONAL MUSEUM
OF VICTORIA

NOTES ON AUSTRALIAN BUTTERFLIES IN THE AUSTRALIAN MUSEUM. No. I.

By

G. A. Waterhouse, D.Sc., B.E., F.R.E.S.,
Honorary Entomologist, The Australian Museum.

It is my intention from time to time to publish notes on any important specimens of butterflies that are received at the Museum. This part contains a fuller description of two rare species, with the first account of the other sex of the known holotype. A new genus and a new race for Australia are also described.

Family ERYCINIDAE.

Libythea geoffroy Godart, 1819.

This species has a wide range from southern Burma through the islands of the Malay Archipelago eastwards to the Solomon and Loyalty Islands. It is very rare in Australia and very little is known of its habits. In Seitz Macrolepidoptera it is stated to prefer dried-up river beds and also rests on wet rocks and on the beach. Sometimes in the dry season the butterflies gather in great numbers at wet places on the roads. In the Marquesas a very distinct species, *L. collenettei* Riley, 1928, is found, of which only three females are known. This is perhaps a remarkable extension of *L. geoffroy*, and we may expect to find forms of *Libythea* on the islands between the Solomons and the Marquesas.

The species of *Libythea* are noted for their very long palpi and this species for its sexual dimorphism. The rare eastern Australian race has been known for nearly fifty years, and I now add another smaller race from north-western Australia.

Libythea geoffroy nicevillei Olliff.

Libythea myrrha Godart, Olliff, Australian Butterflies, 1889, p. 21. ♀ figured.

Libythea nicevillei Olliff, Proc. Linn. Soc. N.S. Wales (2), vi, 1891, p. 28. Cape York and New Guinea.

Libythea geoffroyi Godt., Kershaw, Vict. Naturalist, xvi, 1899, pp. 72–4. Herberton, Qld.

Libythea geoffroyi Godt., Lower, Trans. Roy. Soc. S. Aust., xxxi, 1907, p. 169, sexes reversed; *l.c.*, 1908, p. 317, sexes corrected.

Libythea geoffroy nicevillei Olliff, Frühstorfer in Seitz, Macrolepidoptera, ix, p. 771. Lord Howe Island (*loc. err.*).

Libythea geoffroyi nicevillei Olliff, Waterh. and Lyell, Butterflies of Australia, 1914, p. 67, figs. 62, 63.

The holotype is a female in the Australian Museum with a label Cape York. It agrees very well with Olliff's figure (1889) and his description (1891). Kershaw was the first to describe the male of this race, but his locality (Herberton) requires confirmation. Lower in 1907 confused the sexes, but corrected his mistake in 1908. It is hard to understand how the impossible locality of Lord Howe Island given by Frühstorfer came about, as I cannot find mention of that locality anywhere.

This race must be very rare, as I do not think that I have seen ten specimens; the Australian Museum contains only five specimens: a male from Cape York fig. 62, 1914) and two other males (one with only three wings) from Banks Island; the holotype female from Cape York, and another female (fig. 63, 1914), probably from Cooktown (it was received from Lower without locality). There are none in the Macleay Museum, Sydney, or the National Museum, Melbourne. The South Australian Museum has a female from Somerset, Cape York, caught in January, and a pair from Chillagoe.

♂. *Above.* Forewing violet, sometimes extending beyond vein 6, viewed at some angles bluish; costa, apex broadly, and termen dark brown; white spots in 4, 5 and 6, the last much nearer the base, in some cases indication of a whitish patch divided by vein 3; veins dark brown. Hindwing, base violet, rest of wing brown, with a transverse band of three pale orange spots beyond cell. *Beneath.* Forewing brown, apex broadly, and costa pale grey sprinkled with purple dots; spots as above white, with a spot above that in 6; a large quadrate spot in 2 and a much smaller one above it in 3; a whitish spot at lower end of cell, remainder of cell orange. Hindwing pale grey marbled with purple.

♀. *Above.* Forewing dark brown, pale orange at base and dorsum; three pure white spots in 4, 5 and 6, as in male, another smaller above last; an almost ovoid pure white spot at end of cell and a large quadrate pure white spot in middle of 2 and a narrow one in 3 immediately above. Hindwing dark brown, pale orange at base; a broad transverse orange band just beyond cell. *Beneath.* Forewing as in male; hindwing much more uniformly marked and without the purple patches of the male.

The holotype female has the spot in 2 of the forewing larger than in fig. 63 and its lower edge extending more towards the termen.

Length of costa of forewing: ♂ 29–31 mm.; ♀ 28–29 mm.

Libythea geoffroy genia, subsp. nov.

Libythea geoffroyi nicevillei Olliff, Waterh., What Butterfly is That?, 1932, p. 94, part, pl. xiii, figs. 12, 12A.

This race from Wyndham, N.W. Australia, is much smaller than the eastern race, and the white spots above are more prominent and proportionately larger. The orange band of the hindwing above is more distinct, especially in the female, in which its outer edge is very wavy.

♂. *Above.* Forewing violet, not extending above vein 6 in holotype; costa, apex broadly and termen dark brown; the usual three pure white spots towards apex, in one specimen another white spot above that in 6; in holotype and another a white spot at lower end of cell and a distinct spot in middle of 2, with another above it in lower part of 3; veins not so distinctly brown as in the eastern race. Hindwing brown, base violet; a pale orange transverse band of three spots separated by the veins. *Beneath.* Forewing brown, paler on dorsum, apex grey marbled with purple and brown; all white spots as above, but more distinct, especially that above the spot in 6; an indistinct spot just beyond the upper end of cell; remainder of cell pale orange. Hindwing grey, marbled with purple and brown.

♀. *Above.* Forewing dark brown, red towards base; seven pure white spots, one at lower end of cell, one large curved basad in middle of 2 and another smaller in 3 immediately above it, spots in 4 and 5 joined forming a large comma, spot in 6 with another smaller above it. Hindwing dark brown, paler towards base, and dorsum with a distinct orange transverse band not divided by the veins, lower edge very irregular; a small pale orange spot in 7. *Beneath.* Forewing much as above, but with apex grey sprinkled with brown; dorsum paler and basal two-thirds of cell orange. Hindwing grey uniformly sprinkled with brown.

The male is variable. Specimens in which the white spots of the forewing are more distinct above have less violet. Those with pale brown hindwings above have also more violet and the transverse band very indistinct. Some specimens have a distinct pale transverse band on hindwing beneath. The allotype female is about the size of the figure of *geoffroy* in Seitz, Macrolepidoptera, but has the band above much more irregular than in that figure.

Wyndham, in March, caught by Mr. T. G. Campbell, who found them settled under the veranda during the heat of the day. Mr. G. Lyell has a small specimen from Darwin which is no doubt this race.

Length of costa of forewing: ♂ 19–23 mm.; ♀ 22–25 mm.

Genus **Praetaxila** Frühstorfer.

Praetaxila Frühstorfer in Seitz, Macrolepidoptera, ix, 1914, p. 793.

Holodesmus Waterh. and Lyell, Butterflies of Australia, 1914, p. 68.

Mr. F. G. Griffen has shown (Trans. Roy. Ent. Soc. London, lxxxv, 1936, p. 243) that the dates as printed on the various parts of Seitz "Macrolepidoptera of the World" are in many cases inaccurate, being often in advance of the actual date of publication. He found that the part containing the description of *Praetaxila* was received at the British Museum of Natural History on 26th July, 1914. It then became necessary to ascertain, if possible, the actual date of publication, as both genera cited above have the same orthotype, *Sospita segecia* Hewitson, 1861. At my request, Mr. Griffen wrote to the publishers and he has shown me their reply, which states that the part (Bogen 100) containing the description of *Praetaxila* was published on 23rd July, 1914, although that part is dated 24th March, 1914. This genus then has two days' priority over *Holodesmus*, since the "Butterflies of Australia" was published at Sydney on 25th July, 1914.

Family LYCAENIDAE.

Zetona, gen. nov.

Forewing with costa arched; vein 11 well separated from 12; origin of vein 11 nearer base than origin of 2; vein 7 from just before end of cell; vein 9 absent. Hindwing with tornus rounded. Eyes smooth; palpi with third joint long, slender, slightly curved upwards; antennae slightly flattened, but not hollowed. Orthotype, *Zizera delospila* Waterhouse, 1903.

In shape this genus reminds one of *Pithecops* Horsfield and *Neopithecops* Distant. The orthotype has two spots *in* the cells of the wings on the underside, a character which is found in *Lucia limbaria, Paralucia aurifer* and *P. aenea* in Australia and *Lycaena phlaeas* in the Holarctic Region. These species and their allies may possibly form a special group of the Lycaeninae. Two spots in the cells on the undersides are also found in some species of Theclinae.

Zetona delospila Waterhouse.

Zizera delospila Waterh., Proc. Linn. Soc. N.S. Wales, 1903, p. 211, pl. ii, fig. 5. ♀.

Zizina delospila Waterh. and Lyell, Butterflies of Australia, 1914, p. 106, fig. 255. ♀.

The holotype of this species is a female in the Macleay Museum, University of Sydney. When I described it in 1903 I thought it might be that sex, but in 1914 the sex was incorrectly given as a male. Now that I have seen both sexes there is no doubt that the holotype is a female.

When in London in 1936 I was fortunate in finding three males and a female in the British Museum of Natural History, all caught by Commander J. J. Walker, R.N., at Queen's Islet in June, 1890. One of these males is now before me and also the holotype female.

♂. *Above.* Dull brown with a faint purple tint over most of the centro-basal areas of both wings. Cilia white, at terminations of veins brown. *Beneath.* Forewing white with dark brown spots, one in cell at one-third from base, another at two-thirds with a spot in 1 immediately below, a bar at end of cell, a discal series of spots in 1–6 and 9 and 10, the latter two near costa, the spot in 4 moved towards base and that in 6 away from base; subterminal area with continuous brown blotches from which extend white streaks towards termen; terminal line dark brown. Cilia as above. Hindwing white with dark brown spots, one in cell near base with one above and two below in a line, another beyond middle of cell with one above and one below almost in a line, a bar at end of cell, a discal series of 8 spots from middle of dorsum, that in 4 moved towards base, an extra spot in base of 2 on left side only; a subterminal series of 8 obscure spots; terminal line dark brown extending along the veins. Cilia as above.

♀. *Above.* Dull brown with cilia more chequered and termen of forewing more bowed than in male and without the purple tint. *Beneath.* Forewing as in male, but no discal spots in 1 or 10. Hindwing as in male, but spot in base of 2 on both sides.

Only five specimens are at present known. The holotype female probably came from King's Sound, and Queen's Islet is somewhat north-east of this.

Virachola democles (Miskin).

Deudorix democles Miskin, Trans. Ent. Soc. London, 1884, p. 95. Basilisk Range (Johnstone River, N. Queensland). Two defective males.

Rapala democles Waterh. and Lyell, Butterflies of Australia, 1914, p. 133, figs. 276, 277. Prince of Wales Is. (May). One defective male.

Until this year only three defective males of this rare species were known. Now, thanks to the efforts of Messrs. L. Franzen and M. J. Manski, the Museum has received bred specimens from Cairns, and I am able to give a better account of its systematic position, a fuller description of the male and of the hitherto unknown female. Mr. Manski has also supplied me with an account of its life history.

The species undoubtedly belongs to the genus *Virachola* Moore, 1881, and is probably an eastern development of *Deudorix perse* Hewitson, 1863, the genotype. It agrees with the generic characters given for *Virachola* by Evans in his "Identification of Indian Butterflies", 2nd Edition, 1932, p. 206, in that in the forewing veins 6 and 7 arise from a point, the lower discocellular is slightly concave, and veins 11 and 12 are parallel and separate. In the allied genus *Rapala*, which also has secondary sexual characters in the male, veins 6 and 7 are separate, the lower discocellular is straight, and veins 11 and 12 are close. Its life history resembles that of *Deudorix*, which has no secondary sexual characters in the male, as the larvae feed on seeds, while those of *Rapala* are said to feed on young leaves.

The two males, now in the Queensland Museum, on which Miskin based his description are very worn and without tails, but distinctly show the sexual characters, omitted by Miskin. The third male, now in the Australian Museum, has a filamentous tail to vein 2 of the hindwing on the left side, but the tornal area of both sides is very defective.

♂. *Above.* Forewing with a pointed apex, straight termen and dorsum slightly bowed at about one-third from base; broadly black with a shining blue area reaching base, extending along dorsum to two-thirds and reaching slightly above vein 2 and just into cell. Cilia pale brown. Hindwing elongated towards tornus, a black, white-tipped filamentous tail to vein 2 and a well-defined anal lobe; costa broadly black, diminishing in width along termen to tornus, abdominal margin broadly grey-black, central area extending nearly to tornus, but not reaching base, shining blue; anal lobe with black centre surrounded with pale brown. Cilia pale brown, white near veins 2 and 3 and black and white round anal lobe. Sex mark at base of 6 extending into 7 and just into cell. *Beneath.* Forewing grey-brown faintly tinted with purple, paler on dorsum, a much darker elbowed discal band margined with white from between veins 1 and 2 to costa; a broad dark bar at end of cell extending well within and without cell, an indistinct subterminal interrupted series of spots and a dark brown terminal line. Cilia more prominent than above. A pencil of strong black hairs on dorsum where it is bowed. Hindwing grey-brown, apex broadly white, just extending into cell, a darker discal band from dorsum at one-half to costa margined with white, a broad bar at end of cell divided by a white line along discocellulars, an indistinct interrupted subterminal series of spots, terminal line almost black, especially near tornus, anal lobe black, a circular subterminal spot in 2, set in a pale yellow area and crowned with metallic blue scales, also subterminal pale blue scales near tornus. Cilia pale brown to white near tornus.

♀. Both wings, especially the hindwing, much broader than in the male. *Above.* Forewing with costa and termen broadly black, blue area much more extensive and less heavily scaled, a central white area usually wholly beyond cell and usually wholly confined between veins 2 and 5. Cilia pale brown. Hindwing as in the male, blue more extensive and paler especially in 5. *Beneath* as in male, but paler and without the purple tint; discal band of forewing usually from vein 1.

Eyes slightly hairy, between eyes very pale brown; third joint of palpi slightly longer in the female.

The male is the same shape as the larger *Deudorix epirus agimar* Frühstorfer, 1908, but the blue is deeper in colour than in that species. The female is more like *agimar*, which has a greater white area on the forewing, and also a large white area on the hindwing. Beneath the two species are widely different.

Described from one male and females from Cairns, emerged from pupae at the end of June and early in July.

In June Mr. Franzen and Mr. Manski were collecting near the Barron River, Cairns, when they noticed a number of berries of the rambler *Strychnos Bancroftiana* lying on the ground. Some of these had holes in them, and Mr. Franzen, who had bred *D. epijarbas diovis* Hewitson from the berries of *Harpullia pendula*, suspected these holes were made by the larvae of this or an allied species. They pulled the rambler down and found larvae and pupae in the berries. Some of these pupae have emerged and reached the Museum in perfect condition, for which our best thanks are due to these two entomologists.

Larva with head light brown, first and second segments white with six black spots, four forming a diamond with two central spots, then three segments dark brown, then two white segments turning pink before pupation, then three dark brown segments and the remaining segments white. The larva is shiny, with a few short hairs. The sides of the larva are greenish and somewhat flattened. The larvae feed on the kernels of the rambler. Pupa all brown in some cases or dark brown wing cases with thorax and abdomen pinkish in others; short, squat and fastened with a central girdle inside the berry husk. The pupa before me is pale brown with darker markings, ovoid in section, smooth and short, similar to that of *D. diovis*, but without the short hairs. These short squat pupae are caused no doubt by the larvae pupating within a confined space. No larvae or pupae were found inside the husks on the ground. The butterflies emerge about 9.30 a.m. and have a very swift flight.

DESCRIPTIONS OF SOME NEW GUINEA FISHES.

By

GILBERT P. WHITLEY,
Ichthyologist, The Australian Museum.

(Figure 1.)

THE Australian Museum recently received from Flight-Lieutenant Stuart Campbell, R.A.F., of Port Moresby, Papua, a fine series of freshwater fishes collected by him from the upper Fly River, Papua, about thirty miles above d'Albertis Junction. When identifying this collection from such a little known region, I examined a few other species from remote parts of New Guinea, and now put these on record in view of the interest which is nowadays being taken in the fauna of that country. The freshwater fishes of the Fly River are allied to those of other rivers along the southern coastline of New Guinea and also to the fluviatile species of the Aru Islands, Port Essington, and the Northern Territory generally, and the rivers of the Gulf of Carpentaria. The northern New Guinea freshwater fauna is quite distinct from the southern. In this paper, fishes from both areas are discussed, also an interesting eel from the interior.

Family PLOTOSIDAE.

Genus **Neosilurus** Steindachner, 1867.

Neosilurus brevidorsalis (Günther).

Copidoglanis brevidorsalis Günther, Ann. Mag. Nat. Hist. (3), xx, 1867, p. 66. Cape York, Queensland, and Nicol Bay, W.A. *Id.*, Weber and Beaufort, Fish Indo-Austr. Archip., ii, 1913, p. 241.

Several specimens of a catfish were secured. The largest of the present series has only one ventral fin (the left); if the other had been lost through injury, there is now no trace of it and no scar.

Head about 5 in length without tail. Eye about one-sixth head. Nasal barbel longer than head. Anterior nostril above upper lip and pointing forward. Thirteen slender gill-rakers on lower half of first branchial arch. There is a membrane over their bases. No dendritic preanal organ. No axillary pore. Whole of first dorsal fin invested with skin. Dorsal spine ossified, not serrated, and its fin evidently degenerate.

Seven specimens, 108–230 mm. in total length. Austr. Mus. Regd. Nos. IA.7224 to 7227.

Upper Fly River (Stuart Campbell).

Lambertichthys, gen. nov.

Lambertia Perugia, Ann. Mus. Civ. Genova (2), xiv, 1895, p. 550. Haplotype, *L. atra* Perugia from Inawi, New Guinea.

The generic name of this Papuan catfish is preoccupied by *Lambertia* Robineau-Desvoidy, Hist. Dipt., ii, 1863, p. 30, a genus of flies, and *Lambertia* Souverbie, Journal de Conch., xvii, 1869, p. 420, a molluscan name which has been omitted from the Nomenclator Animalium. I accordingly rename the fish *Lambertichthys*, with *L. atra* as genotype, that species being generically distinct from true *Copidoglanis* Günther.

Family TACHYSURIDAE.

Genus **Cinetodus** Ogilby, 1898.

Cinetodus froggatti (Ramsay and Ogilby).

Arius froggatti Ramsay and Ogilby, Proc. Linn. Soc. N.S. Wales (2), i, May 25, 1886, p. 14. Strickland River.

I have figured elsewhere[1] the unique holotype of this catfish.

The Australian Museum houses the types and other specimens described from the Strickland River by Ramsay and Ogilby, also many of Macleay's Goldie River collection, and I have utilized some of these in identifying Mr. Campbell's collection.

Family ANGUILLIDAE.

Genus **Anguilla** Shaw, 1803.

Anguilla interioris, sp. nov.

(Fig. 1.)

A skin of a very interesting long-finned freshwater eel from inland New Guinea has been in the Museum for some years, but this seems an appropriate place to give some descriptive notes about the specimen. Measurements have been taken as accurately as possible, since the eel was skinned posterior to the pectoral fins.

Head (115 mm.) 8·3 in total length. Depth of head, 55 mm. Upper jaw, 55 mm. Gill opening, 16 mm. Eye, 10 mm. Interorbital, 28 mm. Snout, 30 mm. Pectoral fin, 42 mm. Depth of body (75 mm.), nearly 13 in the total length (960 mm.). Snout to dorsal origin, 270 mm. Snout to anal origin, 410 mm. Level of dorsal to anal origin, 140 mm. The (*a–d*) percentage is 14·58.

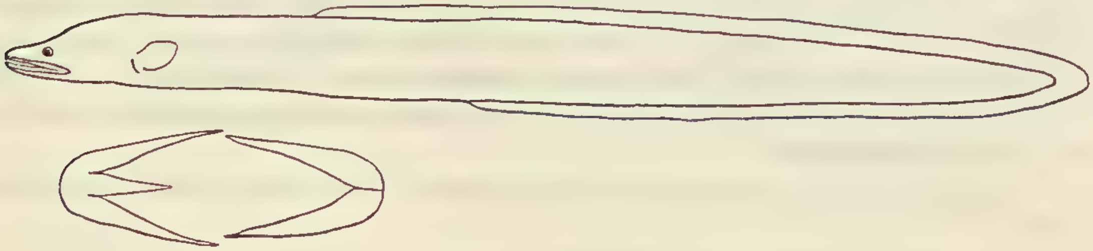

Fig. 1.—*Anguilla interioris* Whitley. Holotype, 960 mm. long, from central New Guinea. Austr. Mus. Regd. No. IA. 6075.

G. P. Whitley, *del.*

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[1] Whitley.—Rec. Austr. Mus., xix, 4, 1935, p. 216, fig. 1.

General habit of *Anguilla*, with the acutely sloping head broad. Interorbital sunken, its concavity extending back to the bulbous vertex of the head. Eyes small. Anterior nostrils in tubes overhanging lip; posterior pyriform, just before eye. Lips fleshy, reaching well behind eye. Teeth fine, rather sparse, situated on broad bands on jaws and vomer, the vomerine patch tapering posteriorly, its greatest breadth occurring where it joins the maxillary series, from which it is not markedly distinguished anteriorly. The maxillary and mandibulary series of teeth are *not* divided by a groove into an outer and inner band.

The whole fish was covered with a thick layer of adherent mucus. Skin pitted by scale pockets, in which lie scales with reticulating ridges on their surfaces. Dorsal fin much longer than anal. Fins invested with thick skin so that rays cannot be counted, but there appear to be 18 pectoral rays. The vertebrae have been removed.

Colour in alcohol, fairly uniform dark brown. A narrow whitish edging around tip of caudal. There are apparently no spots, though the presence of mucus makes colour difficult to see.

Described and figured from the holotype of the species, a specimen 960 mm. or over 38 inches long. Austr. Mus. Regd. No. IA.6075.

Loc.—Gumanj, a tributary of the Wahgi River, Mount Hagen district, upper Purari River, Central Mandated Territory of New Guinea. Altitude, 5,700 feet. From available maps, this river system does not appear to communicate directly with the sea.

Presented by Mr. J. Taylor, who stated that it was a common species.

On comparing this eel with those described in the late Johannes Schmidt's well-known papers, it is at once seen to differ markedly in its (*a–d*) percentage and dentition from such species as *A. reinhardtii*, *australis*, *obscura*, *bicolor*, *pacifica*, *spengeli*, and others from the Indo-Pacific region.

Anguilla marmorata Quoy and Gaimard, from Waigiu, has the dorsal fin not far behind gill opening and is figured with large teeth.

The extensive mouth separates the New Guinea specimen from *malgumora* and *celebesensis*, but it agrees with the latter species better than with the others. It is, however, further distinguished by its head proportions, as listed above.

Family HEMIRAMPHIDAE.

Genus **Zenarchopterus** Gill, 1863.

Zenarchopterus novaeguineae (Weber).

Hemiramphus (*Zenarchopterus*) *novae-guineae* Weber, Nova Guinea, ix, 4, 1913, p. 553. Lorentz River.

Zenarchopterus novaeguineae Mohr, Zool. Jahrb., lii, 1926, p. 247, fig. 12, and "Übersichtstabelle".

D.14. A.ii/10.

Length of triangular part of upper jaw	11 mm.	10	7
Width of triangular part of upper jaw	9 mm.	8·5	6

Three specimens up to about 245 mm. overall. Austr. Mus. Regd. Nos. IA.7262–7264.

Upper Fly River (Stuart Campbell).

Family ATHERINIDAE.

Genus **Craterocephalus** McCulloch, 1912.

Craterocephalus annator, sp. nov.

Br.7; D.vii/i, 8; A.i, 10; P.13; C.15. Four interdorsal and 15 predorsal scales. Sc.36. L.tr.8.

Head (20) 3·6, depth (15) 4·9 in standard length (73·5). Eye (6) 3·3, interorbital (7) 3, snout (5) 4, depth of caudal peduncle (6·5) 3, pectoral (12) 1·6 in head.

Head wedge-shaped, without spines. Mouth small, not reaching eye. Jaws extensible, with extremely fine teeth. Mandible with a small rounded ascending ramus. Premaxillary processes short, less than eye-diameter. One row of scales on cheek. Interorbital scaly. About seven stumpy gill-rakers on lower limb of first branchial arch.

General form, robust, elongate. Anus situated a little before the adpressed tips of the ventrals, followed by seven scales before the anal fin is reached.

Caudal peduncle shorter than depth of body. Height of first dorsal fin equal to interdorsal space. Spinous dorsal arising in advance of level of anus. Anal fin originating before level of soft dorsal origin. Ventral origin nearer that of pectoral than origin of anal. Caudal forked.

A few white cysts on membranes of right pectoral fin. A smaller specimen has 37 vertebrae.

Colour in formalin, very pale yellowish, the fins white. A broad silvery and dusky band along middle of sides from snout to root of tail. Scales of upper half of fish with dusky margins formed by dark grey chromatophores, some of which, along the back, form minute blue ocelli, visible only under a microscope. Eye bluish.

Described from the holotype of the new species, the largest of seven specimens, 50–73·5 mm. in standard length. Austr. Mus. Regd. No. IA.7228, holotype and paratypes.

Loc.—Fly River, Papua: about thirty miles above d'Albertis Junction. Freshwater. Flight-Lieutenant Stuart Campbell.

The more slender form, snout shorter than eye, shorter pectorals, and smaller size distinguish this novelty from *Atherinichthys nouhuysi* Weber, 1910, from the Lorentz River and its tributaries. The coloration and proportions separate it from all its Australian allies. *Craterocephalus randi* Nichols and Raven, 1934, from Kubuna, north-west of Port Moresby, is still slenderer, has at least one row of spots below the lateral band, whilst the anal fin has only seven (or at most nine) rays. Nichols and Raven counted 18 or 19 predorsal scales, though a paratype had 16.

Family MELANOTAENIIDAE.

Genus **Melanotaenia** Gill, 1862.

Melanotaenia nigrans (Richardson).

Atherina nigrans Richardson, Ann. Mag. Nat. Hist,, xi, March 1, 1843, p. 180. King's River, near Port Essington, Northern Territory.

Melanotaenia nigrans Regan, Trans. Zool. Soc. Lond., xx, 6, March, 1914, p. 279 (references and synonyms).

Eight specimens, 43–61 mm. in standard length. Austr. Mus. Regd. Nos. IA.7246–7249.

Upper Fly River (Stuart Campbell).

Genus **Rhombosoma** Regan, 1914.

Rhombosoma goldiei (Macleay).

Aristeus goldiei Macleay, Proc. Linn. Soc. N.S. Wales, viii, 1883, p. 269. Goldie River. Types in Austr. Mus. seen.

Rhombatractus goldiei Weber and Beaufort, Fish. Indo-Austr. Archip., iv, 1922, p. 304 (references and synonyms).

Rhombatractus archboldi Nichols and Raven, Amer. Mus. Novit., 755, Nov. 17, 1934, p. 1, figs. 1–2. Wuroi, Oriomo River.

A series of seven specimens up to nearly 130 mm. in standard length. There is usually a diffuse blackish blotch on the sides near the tip of each pectoral fin besides the usual lateral band. Austr. Mus. Regd. Nos. IA.7241–7245.

Upper Fly River (Stuart Campbell).

Rhombatractus archboldi appears to be a synonym of *goldiei*, Nichols and Raven having compared their specimens with *northern* New Guinea material apparently wrongly identified as *goldiei*, which is this southern species.

Genus **Amneris** Whitley, 1935.

Amneris rubrostriata (Ramsay and Ogilby).

Nematocentris rubrostriatus Ramsay and Ogilby, Proc. Linn. Soc. N.S. Wales (2), i, May 25, 1886, p. 14. Strickland River, Papua. Type in Austr. Mus. seen.

Amneris rubrostriata Whitley, Rec. Austr. Mus., xix, 4, Sept. 19, 1935, p. 226, fig. 5 (refs.).

A fine series of 27 specimens up to 113 mm. from snout to hypural joint. Austr. Mus. Regd. Nos. IA.7229–7240.

Upper Fly River (Stuart Campbell).

Genus **Centratherina** Regan, 1914.

Centratherina bulolo, sp. nov.

D.iv/i, 8. A.i, 22. P.ii, 13. Sc.37. L.tr.13. Predorsal scales about 17. Head (15 mm.) 4, depth (19) 3·1 in standard length (60). Pectoral fin (11) 1·3, eye (5) 3, snout (3·6) 4·1, interorbital (6) 2·5, upper jaw (5·5) 2·7 in head. Predorsal length (30) 50% of standard length.

Head acutely wedge-shaped, eyes swollen. Three rows of scales on cheeks. Jaws barely reaching level of front of eye. The upper jaw slightly overhangs the lower, and both are provided with numerous strong peg-like teeth *outside* the mouth, extending over lips and along maxillaries. Smaller normal teeth lie in bands inside the mouth, which is horseshoe-shaped and not markedly notched laterally. Vomer edentulous. Snout shorter than eye, interorbital space, or postorbital part of head.

Body compressed, slender, covered with large cycloid scales, some of which have their margins very slightly crenulated. Predorsal profile evenly sloping, not markedly excavate. Ventral profile convex. Caudal peduncle much longer than deep.

Fins of the usual Melanotaeniidae disposition; the anal originating only slightly in advance of vertical of first dorsal spine. The dorsal spines are all fairly strong, but the first is most thick and pungent, yet not so long as those following it. Anal spine slightly less than eye-diameter in length.

Colour, in alcohol, ruddy yellowish, sparsely sprinkled with black chromatophores dorsally. A silvery lateral band posteriorly. Fins with stippled dusky margins; upper and lower caudal rays infuscated.

Described from the holotype, a specimen 60 mm. in standard length, or 2¾ inches overall. Austr. Mus. Regd. No. IA.6357.

Loc.—Bulolo Valley, Mandated Territory of Papua; freshwater.

Presented by Mr. F. B. S. Hislop in 1934.

Differs from *C. crassispinosa* (Weber, 1913), type of the genus, in having the anal fin originating further back, in having the snout shorter in relation to eye, fewer scale-rows and predorsal scales, and longer posterior dorsal spines. Weber's types came from Tawarin River, and he also had specimens from Sermowai River and Kaiserin Augusta (now the Sepik) River.

In no other genus of Melanotaeniidae are the external teeth so well developed as in *Centratherina*, and these, as Weber noted regarding an allied genus, are doubtless used for scraping for food. He wrote:[2]

"Instead of being prehensile, the jaws make scraping movements. I experienced this when bathing in Lake Sentani, in northern New Guinea. *Chilatherina sentaniensis* occurred there in large numbers along the shore, and, when standing bare-legged in the clear water, I could feel and see how the fishes scraped at the skin of my legs."

Family TERAPONTIDAE.

Genus **Terapon** Cuvier, 1816.

Terapon trimaculatus Macleay.

Therapon trimaculatus Macleay, Proc. Linn. Soc. N.S. Wales, viii, 2, July 17, 1883, p. 259. Goldie River, Papua. *Id.* McCulloch and Ogilby, Mem. Qld. Mus., v, 1916, pp. 102 and 120, pl. xiii, fig. 1.

D.xiii/12(13); A.iii/8(9). L.lat.50 to hypural joint. L.tr.7/1/14. Head (17 mm.) 2·7, depth (17·5) 2·7 in standard length (47).

General characters as described by McCulloch and Ogilby. Preoperculum very strongly serrated. Lower opercular spine well developed, but not reaching opercular lobe.

Suprascapular small, dentate. Fourth to six dorsal spines longest, longer than the rays. Second anal spine longest and strongest. Caudal emarginate.

Colour silvery, grey towards back and on edges of scales. Unpaired fins slightly infuscated. Eye blue. No bands, spots or blotches on body or fins.

One specimen, standard length 47 mm. Austr. Mus. Regd. No. IA.7222.

Upper Fly River (Stuart Campbell).

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[2] Weber.—Bijdragen Dierkunde Nat. Artis Mag. Amst., xxii, 1922, p. 262.

Family APOGONIDAE.

Genus **Glossamia** Gill, 1863.

Glossamia aprion (Richardson).

Apogon aprion Richardson, Ann. Mag. Nat. Hist., ix, March 1, 1842, p. 16. King's River, Port Essington, Northern Territory of Australia.

Glossamia aprion McCulloch, Rec. Austr. Mus., xi, 1917, p. 169, text-fig. 1.

D.vi/i, 10; A.ii, 9; P.14. L.lat.41. L.tr.4/1/13 or 14.

Head (36 mm.) 2·3, depth of body (31) 2·7 in standard length (86), eye (9) 4, interorbital (6·5) 5·5, snout (7) 5·1, second dorsal spine (16) 2·2, depth of caudal peduncle (13) 2·7 in head.

Head acutely pointed, profile not so excavate as in McCulloch's figured specimen. Maxillary broad, reaching to below posterior half of the large eye. Bands of fine teeth on jaws, vomer, palatines and posterior part of tongue. No canines. Opercular spine obsolescent. A few weak serrations at preopercular angle. Suprascapular crenulated. Form deep, compressed, body covered with ctenoid scales. Lateral line complete. Caudal bilobed. General characters as in McCulloch's description.

Colour dull olivaceous with greyish or smoky margins to fins, dusky top of head, and infuscated fins. A few very indistinct dusky stripes behind eye and along maxilla and chin. Belly silvery. Eye blue.

Described from the smaller of two specimens, 86–104 mm. in standard length. Austr. Mus. Regd. Nos. IA.7220–7221.

Loc.—Upper Fly River (Stuart Campbell).

Family CHANDIDAE.

Genus **Austrochanda** Whitley, 1935.

Austrochanda macleayi (Castelnau).

Pseudoambassis macleayi Castelnau, Proc. Linn. Soc. N.S. Wales, iii, Sept., 1878, p. 43. Norman River, Gulf of Carpentaria.

Austrochanda macleayi Whitley, Rec. S. Austr. Mus., v, 3, Sept., 1935, p. 357, figs. 6–7 (references and synonyms).

D.vii/i, 9 (10); A.iii, 9 (10); P.i, 13; V.i, 5; C.15. Eleven predorsal scales. L.lat.6..1.1/15 on right side and 6.5/13 on left side. L.tr.3/1/10½.

Head (23 mm.) 2·8, depth (27) 2·3 in standard length (64). Eye, 8mm.; interorbital, 5; snout, 4·2; second dorsal spine, 18; and depth of caudal peduncle, 9·5 mm.

Profile of head excavated. Supraorbital with only one spine posteriorly. Suborbital with a few strong serrations. Preorbital markedly serrate. Preopercular margin and lower limb serrated. Interoperculum serrated. Operculum entire. Two rows of cheek scales. Lower jaw the longer. Bands of minute teeth in jaws. Maxillary not dilated at its extremity. Body compressed, not very deep.

Three anal spines, the third longest. Dorsal and anal fins each with nine rays, the last divided to its base to give the appearance of a tenth. Recumbent dorsal spine not exposed.

Lateral line interrupted, but tubes, where present, well developed.

Colour pale yellowish, the scales margined with dark grey chromatophores which are densest along dorsal surface, although they also form a stippled median band, one scale-row broad. Fins similarly stippled, although the dorsal membrane is not as dark as in some Chandidae.

Described from the largest of six specimens, 44–64 mm. in standard length. Austr. Mus. Regd. No. IA.7223.

Upper Fly River; freshwater (Stuart Campbell).

Genus **Acanthoperca** Castelnau, 1878.

Acanthoperca gulliveri Castelnau.

Acanthoperca gulliveri Castelnau, Proc. Linn. Soc. N.S. Wales, iii, Sept., 1878, p. 44. Norman River, Queensland. Type in Macleay Museum, University of Sydney. *Id.* Whitley, Rec. S. Austr. Mus., v, 1935, p. 360.

Ambassis gigas Ramsay and Ogilby, Proc. Linn. Soc. N.S. Wales (2), i, 1886, p. 9. Strickland River, New Guinea.

This striking Chandid affords another illustration of the uniformity of the Leichhardtian fluviatile fauna, since it occurs in the Norman River and Flinders River, Queensland, as well as in the Strickland River, Papua, and doubtless elsewhere.

Further study of the types of Castelnau's tropical Australian species will be necessary for more exact understanding of the Papuan freshwater fauna.

Family ELEOTRIDAE.

Genus **Ophiocara** Gill, 1863.

Ophiocara aporos (Bleeker) subsp. **rigonis**, nov.

Eleotris aporos Bleeker, Nat. Tijdschr. Ned. Ind., vi, 1854, p. 59. Sindangole and Ternate, East Indies.

Mr. Melbourne Ward secured from his friend, Mr. A. C. English, a series of freshwater fishes for the Australian Museum from a creek near Rigo, Papua; 25 January, 1933. This consists of nineteen specimens, in various stages of growth, of a single species, which I regard as *Ophiocara aporos*. The largest Rigo specimen agrees excellently with Günther's[3] figure in the "Fische der Südsee", pl. 112, fig. B (only) of "*Eleotris macrocephalus*" (error for *macrolepidotus*), from Oualan, but this is not the same as the original *Sciaena macrolepidota* of Bloch[4] from the East Indies.

Günther's fish is associated with *Ophiocara aporos* (Bleeker) in Fowler's "Fishes of Oceania".[5]

The Rigo specimens agree with Bleeker's description very well, except that the coloration is rather different, the eye goes nearly three times in the interorbital space, and Bleeker's statement, "linea rostro-frontali concava", does not fit either my specimens or Günther's figure.

The Rigo fishes have D.vi/9; A.i, 8–10. Thirteen to fourteen predorsal scales and 28–30 transverse rows of scales between shoulder and hypural joint. In all of them the preopercular margins are hidden by scales, and supraciliary scales are present, whilst the mouth barely reaches the eye.

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[3] Günther.—Journ. Mus. Godeff., ii, 9 (Fische Südsee, iv), Feb., 1875, p. 186, pl. cxii, fig. B.

[4] Bloch.—Nat. ausl. Fische, vi, 1792, p. 40, pl. ccxcviii.

[5] Fowler.—Mem. Bish. Mus., x, 1928, p. 391.

I have compared them with cotypes of *Eleotris planiceps* = *aporocephalus* Macleay, from Lillesmere Lagoon, Queensland, and find the Queensland form is larger; has D.v–vi/8–9; A.i, 9; 17 predorsal scales; Sc.28–29, and mouth reaching to below anterior part of eye.

Evidently there are geographical subspecies of *Ophiocara aporos*, and the Rigo type, being distinguished by the low number of predorsal scales, coloration (as in Günther's fig. B), and minor details as noted above, may be named *rigonis*. The holotype is a specimen about eight inches long, numbered IA.5785 in the Australian Museum.

Loc.—Freshwater creek near Rigo, Papua; 25th January, 1933 (A. C. English, per M. Ward).

Genus **Oxyeleotris** Bleeker, 1874.

Oxyeleotris fimbriatus (Weber).

Eleotris fimbriatus Weber, Nova Guinea, v, 2, 1908, p. 254. Etna Bay, S.W. New Guinea. *Id.* Weber, *ibid.*, ix, 1913, p. 594, pl. xiii, fig. 1.

Eleotris (*Oxyeleotris*) *aruensis* Weber, Abhandl. Senckenb. Nat. Gesell., xxxiv, 2, 1911, p. 33, pl. i, fig. 5. Young form from Aru Islands.

Eleotris (*Oxyeleotris*) *mertoni* Weber, Abhandl. Senckenb. Nat. Gesell, xxxiv, 2, 1911, p. 33, pl. ii, fig. 2. Aru Islands.

Oxyeleotris fimbriatus Koumans, Temminckia, i, 1936, p. 267, and Zool. Mededeel., xix, 1936, p. 132 (synonymy and variation).

A series of 22 specimens (IA.7250, 7254 and 7258) from the Fly River is identified as this species, following Koumans. The smallest specimen (IA.7258) is only two inches overall, and has the following characters: D.vi/12; A.i, 9. Sc.35 between shoulder and hypural joint. Tr.14. About 20 predorsal scales.

A small dark grey to brownish gudgeon with head rounded, not flattened. Interorbital with small scales. Cheeks naked. Opercles scaly. No supraciliary scales. A row of small papillae along nuchal canal, others on occiput and crossing cheeks transversely and longitudinally as in gobies. Mouth small, just reaching to below eye. Bands of acute teeth in jaws. No canines.

Preopercular edge hidden, without spine. Body robust, tapering. Scales ciliated. Dorsals approximate, adpressed spines reaching origin of soft fin, which has a long base. Anal shorter, its lobe pointed.

Caudal pointed. Ventral fins separate, each with a spine and five rays. Pectorals pointed.

Dark grey to brownish above, white on belly. Thorax with four or five indistinct oblique bars, and traces of others along tail. Two obscure dark bars from eye to opercle. A black blotch at the shoulder and a dark spot above root of caudal.

This specimen agrees with *Eleotris* (*Oxyeleotris*) *aruensis* Weber, but differs in having much larger scales, more pointed tail, and darker and more diffuse coloration. However, Koumans has shown that the number of scales alters with growth, and regards *aruensis* as the young of *Eleotris fimbriatus* Weber.

Austr. Mus. Regd. No. IA.7254 is a series of twenty rather larger specimens in which the chevron-shaped bands of "*aruensis*" are generally still visible, but already the scales number about 55 to 58 in transverse series, whilst the mouth reaches the eye.

The largest specimen (Austr. Mus. Regd. No. IA.7250) is very like Weber's figure of *fimbriatus*, but has spotted fins.

Loc.—Upper Fly River (Stuart Campbell).

Oxyeleotris herwerdenii (Weber).

Eleotris herwerdenii Weber, Notes Leyden Mus., xxxii, Dec. 30, 1910, p. 238. Lorentz River. *Id.* Weber, Nova Guinea, ix, 1913, p. 594, pl. xiii, fig. 2, and pl. xiv, fig. 2.

One specimen (Austr. Mus. Regd. No. IA.7253), 126 mm. in standard length, from the Upper Fly River, is like Weber's pl. xiii, fig. 2.

Genus **Bostrichthys** Duméril, 1806.

Bostrichthys strigogenys (Nichols).

Bostrychus strigogenys Nichols, Amer. Mus. Novit. 922, May 4, 1937, p. 1, fig. 1. Upper Fly River, Papua. Types in Amer. Mus. Nat. Hist.

D.vi/12; A.i, 8. V.i/5.

Head broad, flattened. Sides of head scaly, crossed by a few rows of papillae. Mouth reaching past eye; mandible protruding. Bands of fine teeth in jaws. No canines. No preopercular spine. Interorbital flat, with very small scales. No supraciliary scales. Gill openings separated by isthmus. Branchiostegal membrane extensive.

Body depressed anteriorly and compressed posteriorly, covered with very small cycloid scales in more than 90 transverse series.

First dorsal fin low, well separated from second. Caudal rounded or somewhat wedge-shaped.

Brown to greyish, with cream edges to fins, thick cream oblique bars on cheeks, and belly mostly light coloured. Some cream spots on root of tail of one specimen.

Loc.—Upper Fly River: about thirty miles above d'Albertis Junction. Collected by Flight-Lieutenant Stuart Campbell.

Two examples, Austr. Mus. Regd. Nos. IA.7251–7252.

Genus **Mogurnda** Gill 1863.

Mogurnda mogurnda (Richardson).

Eleotris mogurnda Richardson, Zool. Voy. Erebus and Terror, Fish., 1844, p. 4, pl. ii, figs. 1–2. Port Essington, Northern Territory.

Twenty-three specimens from the Upper Fly River, similar to the Aru Islands form figured in colour by Weber in 1911.

Austr. Mus. Regd. Nos. IA.7255–7257 (Stuart Campbell coll.).

Family GOBIIDAE.

Genus **Glossogobius** Gill, 1859.

Glossogobius concavifrons (Ramsay and Ogilby).

Gobius concavifrons Ramsay and Ogilby, Proc. Linn. Soc. N.S. Wales (2), i, 1887, p. 12. Strickland River.

Eight specimens (Austr. Mus. Regd. Nos. IA.7259–7261) identified by comparison with the holotype in the Australian Museum.

Loc.—Upper Fly River (Stuart Campbell).

Postscript added August 8th, 1938.

The manuscript of the foregoing paper was completed in June, 1937, before the author left Australia for a trip round the world. Owing to unforeseen delay in publication, some of the nomenclature may require modification. The new *Anguilla* is conspecific with some specimens in the Carlsberg Laboratory, Copenhagen, which had been given a MSS. name by Vilh. Ege, apparently not yet published. Dr. Nichols' paper on *Bostrichthys strigogenys* arrived in time to avoid a synonym being made, but *Ophiocara aporos rigonis* is very close to Koumans' new variety *guntheri* (Zool. Med., xx, 1937, p. 19) from Pelew. *Oxyeleotris herwerdenii* has been recorded from northern Australia by Koumans (*loc. cit.*, p. 25). Dr. Koumans recently visited Australia and examined many of the Eleotridae and Gobiidae mentioned above.

In 1937 the Australian Museum received further New Guinea collections. Flight-Lieut. Stuart Campbell sent species of *Arius*, *Lambertichthys*, *Oxyeleotris*, *Toxotes*, *Acanthoperca*, and *Datnioides* from the upper Sepik River, also a fine Long Tom (*Stenocaulus perornatus*, sp. nov.) with D.ii, 15; A.ii, 18, head 2·4 and depth 8·4 in standard length (495 mm.), no gill-rakers, caudal peduncle elliptical in cross-section, origin of dorsal over second anal ray. Colour yellowish, conspicuously spotted with brown; the large spots on head sometimes coalesce. Holotype, No. IA.7287.

Dr. Carl Gunther forwarded, from the Bulolo goldfields, *Glossogobius circumspectus* (Macleay, 1883), *Rhombosoma affinis* (Weber, 1908; syn. *R. sepikensis* Herre, 1935), and a Gudgeon (*Mogurnda aurifodinae*, sp. nov.) distinguished by having a few dark spots on top of head, D.viii/15, A.14, sc. *circa* 40; the head is 3·3 and the depth 5 in the standard length, which is 90 mm. in the holotype (No. IA.7322).

G. P. WHITLEY.

A NEW STIGMODERA FROM WESTERN AUSTRALIA.

By

H. J. Carter, B.A.,
Honorary Entomologist, Australian Museum.

(Figure 1.)

Stigmodera (Castiarina) flavocoerulea, n. sp.

Oblong. Head, prothorax, scutellum, underside, appendages and elytral apex (narrowly) brilliant blue: elytra otherwise (save for a narrow blue basal border) pale straw colour.

Head widely sulcate, finely punctate.

Prothorax, apex and base lightly bisinuate, the latter nearly twice as wide as former, with a small central fovea and minute basal excisions, all angles wide: sides widely and evenly rounded, without sinuation: disk with a narrow, arcuate ridge at apical third, containing some laevigate spaces; otherwise finely, evenly punctate, the punctures round and moderately close, much finer in middle, without signs of a medial line.

Scutellum elongate, cordiform: sulcate in middle.

Elytra widened at shoulders, widely and lightly constricted behind them; not much narrowed behind, apices sharply bispinose, external spine the longer, subapical margins serrulate: striate-punctate, the striae rather wide, intervals very lightly convex, finely and irregularly punctate. Underside glabrous, nitid, with fine, shallow punctures.

Dim. 16 × 6 mm.

Hab.—Western Australia: Wurarga (Mr. A. Goerling).

A single example sent is so distinctly separated from its allies as to deserve description. In general form and pattern it most resembles *S. luteipennis* L. & G., from which it differs in colour, wider and more convex prothorax and strongly spined apices. In colour its upper surface comes near some of the pale varieties of *S. yarelli* L. & G. (without, however, the yellow border of prothorax). Holotype presented to the Australian Museum.

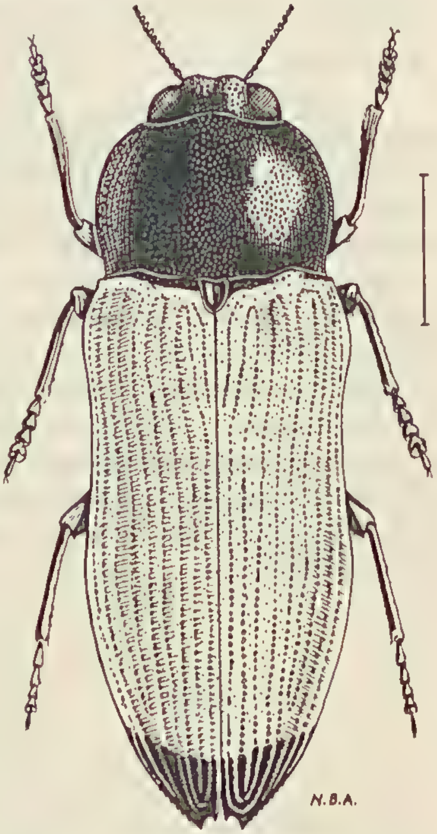

Fig. 1.—*Stigmodera (Castiarina) flavocoerulea*, n. sp.

A REVISION OF THE AUSTRALIAN CONULARIAE.

By

Harold O. Fletcher,
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(Plates xxiv–xxvi.)

Introduction.

The present paper is a revision of the known species of *Conularia* found in Australian rocks, with descriptions of new species.

The actual position in the animal kingdom which this remarkable genus occupies is still doubtful. It has usually been regarded by authors as having pteropod affinities, although opponents to this theory have assigned the genus to many other groups. Miss Slater, in 1907,[1] revising the British Conulariae, stated that on zoological evidence the inclusion of *Conularia* among the Pteropods must be abandoned. After an exhaustive examination of their characters, Miss Slater concludes that the genus should be regarded as "an extinct group, equivalent to the Cephalopods, and derived with them from the same simple-shelled ancestor".

Members of the genus are found distributed among the European rocks from the Upper Cambrian to the Trias and Lias, with a maximum development in Middle, Upper Ordovician, and Silurian times. In Australian rocks the genus is by no means common. Species have now been recorded from the Cambrian, Upper Silurian, Carboniferous, and Permian rocks. The maximum development is in the Permian horizons, where the shells attained large size, a striking feature common to the Permian fauna of Australia.

The specimens used as a basis for this paper have been collected over a period of many years, and as a result localities and horizons may in occasional instances be in some doubt. It is essential, however, that all the Australian groups of fossils should be revised and new species founded when necessary. It is only in this way that a foundation will be laid for workers on this subject. Palaeontology has been neglected to some extent in the past in Australia, and it is most important that more intensive fossil collecting should be done. Collecting must be carried out scientifically, with complete field data, when possible, of stratigraphical sequence in any particular geological horizon. It is only in this way that the palaeontologist can hope to assist the stratigrapher. Süssmilch[2] stressed this point when he stated: "Our present fossil lists are based largely upon material collected and described many years ago; this material was probably not always localized, while many of the descriptions and determinations now possibly need revision."

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[1] Slater.—"A Monograph of the British Conulariae", Palaeontograph. Soc., 1907, pp. 9-12.

[2] Süssmilch.—Aust. and New Zealand Assoc. Adv. Sci., xxii, p. 116.

History of the Genus in Australia.

For many years very little research has been done on the Australian Conulariae. The first reference to the genus was made by Morris[3] in 1845, when that author described and figured specimens from the Illawarra district and Raymond Terrace as *Conularia levigata.* This name, spelt *laevigata,* was also given by Salter[4] in 1866 to a smooth-shelled species of *Conularia* from North Wales; as the name is pre-occupied, I would suggest that the British species be named *C. salteri.*

In 1847, McCoy[5] recorded *C. levigata* from a fine, grey, micaceous sandstone at Black Creek and from the limestone of Harper's Hill, where it was said to be common. He also described what must be considered a very doubtful species of this genus from Muree, as *C. torta.* A finely ribbed form was also described from the same beds, and named *C. tenuistriata.*

Dana in 1849[6] described a series of fossils collected by the Wilkes United States Exploring Expedition, and refers several of them to *C. laevigata* Morris, and *C. tenuistriata* McCoy. A new species, *C. inornata,* was described from the Permian beds of Glendon in the Maitland district.

De Koninck in 1877[7] recorded with reservation a small fragment of shell from the Silurian beds of Black Rock Creek, near Yass, as *C. sowerbyi* (?) Defrance. This determination was arrived at for two reasons: firstly the ornamentation was very similar, and, secondly, the fragment was collected in association with species identified at that time as forms found associated with *C. sowerbyi* in England. The status of *C. sowerbyi* is discussed under the observations of *C. chapmani,* sp. nov., where it is found that, according to the rules of nomenclature, the name *C. sowerbyi* must be dismissed and become a synonym of *quadrisulcata* Sowerby; *C. sowerbyi* must be renamed. De Koninck also recorded *C. laevigata* Morris, *C. inornata* Dana and the British species *C. quadrisulcata* Miller. *C. tenuistriata* McCoy is again recorded from the Muree beds.

R. M. Johnston in 1886[8] recorded *C. laevigata* from Tasmania, and described a new species from Bridgewater, Tasmania; this was named *C. derwentensis,* and two years later[9] the same author figured a specimen as *C. tasmanica* (allied to *C. inornata*). In a list of species on page 116, a species is listed as *C. derwentensis,* but no mention is made of *C. tasmanica,* so there appears little doubt that *C. tasmanica* was printed in error. The characters and dimensions of the figured specimen agree perfectly with those of *C. derwentensis. C. levigata* Morris is recorded and described from the Upper Palaeozoic limestone of the River Styx and Porter's Hill near Hobart. The figure of this species published by Johnston in 1888 is a copy of Morris's original figure.

R. Etheridge, junr., in 1889[10] discussed the structure of *C. inornata,* and in 1901[11] mentioned the upturning of the distal margin of a specimen, *C. levigata,* from the Lower Marine beds of Ravensfield. Several specimens of *Conularia* were exhibited before the Linnean Society of New South Wales in 1902 by Mr. W. S.

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[3] Morris *in* Strzelecki's Phys. Descrip. N. S. Wales, etc., 1845, p. 290, pl. xviii, fig. 9.

[4] Salter *in* Ramsay's Geol. N. Wales; Mem. Geol. Surv., iii, ed. 1, p. 354, woodc. 19 (also ed. 2, 1881, p. 552).

[5] McCoy.—Annals. Mag. Nat. Hist., xx, 1847, pp. 306-8.

[6] Dana.—Wilkes' U.S. Explor. Exped., 1838-42, x, Geology, 1849, p. 709.

[7] De Koninck.—Foss. Pal. Nouv. Galles du Sud, 1877, Pt. 1, p. 43.

[8] Johnston.—Proc. Roy. Soc. Tasmania, 1886 (1887), p. 17.

[9] Johnston.—Syst. Acc. Geol. of Tasmania, 1888, pl. xx, figs. 1, 1*a*-*b*.

[10] Etheridge, junr.—Proc. Linn. Soc. of N. S. Wales (2), iv, 3, p. 751, pl. xx, fig. 1.

[11] Etheridge, R., junr.—Rec. Austr. Museum, iv, 1, 1901, p. 52.

Dun.[12] These were all from the Lower Marine beds of Harper's Hill and Ravensfield, and included *C. inornata* Dana, *C. levigata* Morris, and *C. tasmaniensis* Johnston (possibly an acute form of *inornata*). Dun mentioned that the genus is but seldom met with in the Upper Marine, but is not rare in the Lower Marine, a distribution which additional specimens prove to be incorrect, as *C. inornata* is more commonly met with in the Upper Marine beds than in the Lower.

In 1904 an additional species was added to the Australian list by Chapman,[13] as *C. ornatissima* from the Silurian beds at South Yarra near Melbourne. *C. sowerbyi* Defrance was recorded from a hard, grey mudstone at the junction of the Woori-Yallock Creek and the Yarra River near Melbourne, and from Wilson's, north of Lilydale. Both these localities are in Victoria and the beds Silurian in age.

Laseron in 1911[14] described and figured a beautifully preserved shell as *Conularia* cf. *laevigata* Morris, complete with apertural lobes. He pointed out that his specimens differed from the typical *C. levigata* in possessing four equal faces.

In 1912 the first Western Australian record of this genus was published by Glauert[15] from three crushed fragments collected at Byro Station. These are described as *Conularia* sp. nov., cf. *C. warthi* of Waagen. Miss L. Hosking in 1931[16] also compares the Western Australian species with *C. warthi*, and in 1933,[17] with additional specimens, was able to prove them identical with the Indian Salt Range species.

Conularia levigata Morris and *C. tenuistriata* have been collected and recorded from the Salt Range and Kashmir beds of India. Diener[18] records the latter species from the Ladukh Valley, Kashmir, while Waagen[19] has quoted it from the boulder beds of the Eastern Salt Range in association with *C. levigata*, according to Waagen a common species. It is strange that no trace of *C. inornata* has been found in the Salt Range beds. In Australia this common species is frequently found associated with *C. levigata* and *C. tenuistriata*, and is distinguished by its strong rectangular cross-section compared with the almost square section of *C. levigata*. Diener points out that there is a slight difference in the shape of the transverse section of the Indian *C. tenuistriata*, and suggests that, if this difference in shape be thought a sufficient reason for distinguishing the Salt Range and Kashmir type from the Australian ones by a varietal denomination, the name *Conularia tenuistriata* var. *indica* might be applied to them.

In 1936, Cowper Reed[20] was of the opinion that the form from Kashmir which Diener referred to *C. tenuistriata* McCoy, is identical with *C. punjabica* from the top of the Talchir boulder bed. In the same paper, Cowper Reed described several new species from localities at the base of the Olive Series above the Talchir boulder bed (Punjabian) of the Salt Range. *Conularia tenuistriata* Morris and *C. warthi* Waagen were also recorded.

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[12] Dun.—Proc. Linn. Soc. of N. S. Wales, 1902, xxvii, 3, p. 495.

[13] Chapman.—Proc. Roy. Soc. of Victoria (N.S.), xvi, 2, 1903, pp. 340-1.

[14] Laseron.—Proc. Roy. Soc. of N. S. Wales, 1911, xlv, p. 247, pl. xi.

[15] Glauert.—Rec. W. Austr. Mus. and Art Gallery, 1912, i, 2, p. 76.

[16] Hosking.—Journ. Roy. Soc. West. Austr., xvii, 1931, p. 36, pl. xi, figs. 3-6.

[17] Hosking.—Journ. Roy. Soc. West. Austr. xix, 1933, p. 57.

[18] Diener.—Mem. Geol. Survey of India (Pal. Indica), 1899 (xv), i, 2, p. 18.

[19] Waagen.—Records Geol. Survey India, 1886, xix, p. 25; Salt Range Fossils (Pal. Indica), 1891, iv, 2, p. 123.

[20] Cowper Reed.—Mem. Geol. Survey of India (Pal. Indica), 1936 (N.S.), xxiii, 1, pp. 29-33.

Grouping of the Species.

The genus *Conularia* has at times been subdivided into groups according to the surface characters of the shell. The most important papers on this subject have been by Lindström (1884), Holm (1893), and Boucek (1928). Lindström[21] proposed three subdivisions of the genus, based on the surface characters of five species. Holm[22] later separated the genus into four sections, following Lindström's plan as a basis for his groupings. Boucek[23] formulated an elaborate subdivision after studying forty-two species, from which he placed three in a new genus, *Conulariella*. These were *C. robusta* Barr., *C. purkneyi* Zel., and *C. sulca* Zel.; the remainder were subdivided into seven groups, following the criteria employed by Holm, but also laying emphasis on additional characters.

The Australian species of *Conularia* fall into two groups, and because of this I propose to follow, for the time being, Holm's grouping, which is as follows:

(1) *Laeves*. Surface smooth, without ridges, but frequently with transverse undulations (growth lines).

(2) *Longitudinales*. Surface ornamented throughout with longitudinal ridges, the segmental line having the form of a carina.

(3) *Moniliferae*. Surface ornamented with transverse ridges or tubercles arranged in transverse rows. A: Internal longitudinal ribs present down the centre of each face. B: Internal longitudinal ribs not present.

(4) *Cancellata*. Surface of the shell covered with strong transverse ridges usually cut by very fine longitudinal ridges (cancellated ornamentation).

List of Australian Species.

	Upper Silurian.	Devonian.	Lower Carboniferous.	Permian.	
				Lower Marine.	Upper Marine.
Section I. *Laeves*	—	—	—	—	—
Section II. *Longitudinales*	—	—	—	—	—
Section III. *Moniliferae*—					
Conularia inornata Dana	—	—	—	×	×
,, *levigata* Morris .. .. .. (*non laevigata* Salter)	—	—	—	×	×
,, *tenuistriata* McCoy	—	—	—	×	×
,, *expansa* sp. nov.	—	—	×	—	—
,, *derwentensis* Johnston	—	—	—	×	—
,, *crenulata* sp. nov.	—	—	—	×	—
,, *acutilirata* sp. nov.	—	—	—	—	×
,, *tuberculata* sp. nov.	—	—	×	×(?)	—
,, *mitchelli* sp. nov.	×	—	—	—	—
,, *torta* McCoy	—	—	—	—	×
Section III. *Cancellata*—					
Conularia ornatissima Chapman	×	—	—	—	—
,, *chapmani* sp. nov.	×	—	—	—	—
,, *warthi* Waagen	—	—	—	×*	×
,, *distincta* sp. nov.	×	—	—	—	—

* Ranges from Lyons to Byro Stage. See Raggatt, *Journal and Proc. Royal Soc. of N.S.W.*, lxx, 1936, pp. 100-17.

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[21] Lindström.—On the Silurian Gastropoda and Pteropoda of Gotland. K. Svenska Vet.-Akad., Handb. 49, 1884.

[22] Holm.—Sveriges Kambrisk-siluriska Hyolithidae och Conularidae. Sver. Geol. Undersokning, No. 112, 1893.

[23] Boucek.—Revise Ceskych Palaeozoickych Konularii. Palaeontographica Bohemiae Nr. xi, 1928.

The groups *Laeves and Longitudinales* are unrepresented in Australian rocks. It has been pointed out by previous workers that this method of grouping is not altogether satisfactory, as some species, closely allied, appear in different sections. In some cases species have been tentatively placed in either of the two groups represented in Australia, until further specimens may produce additional evidence.

Description of Species.

Genus **Conularia** Sowerby, 1821 (*ex* Miller MS.).

Conularia mitchelli, sp. nov.

(Plate xxiv, figs. 4–6.)

Description. Shell of medium size, smooth, tapering uniformly. Cross-section an ellipse (?). Faces unequal, convex. Apical angle small, about 10°. Facial grooves inconspicuous, maybe absent. Aperture and apex unknown. Marginal furrows, shallow, narrow and indistinct. Ornamentation fine; transverse ridges narrow 33–36 in 10 mm.), crossing almost horizontally and without any apparent break in the marginal grooves. Uninterrupted by facial grooves. Furrows smooth.

The fragment of shell described is 55 mm. in length, and the greatest width of face is 24 mm.

Observations. There is only a single example of this delicately and finely ribbed form, but it is well preserved and shows most distinctive characters. This species must have attained a considerable length as the apical angle is extremely small. It is a thin-shelled form and the test is to some extent crumpled and wrinkled. It is difficult to determine the actual cross-section. The three faces preserved on the specimen are convex, and a transverse section appears to be a natural ellipse rather than rectangular.

There is no other Australian species with which this Upper Silurian form can be compared. In the ornamentation of the shell the ridges are not bent up regularly to form a succession of chevrons as is usually the case in this group, but are almost horizontal, and in crossing the faces even show a slight tendency towards a downward curve. The latter feature is no doubt caused by pressure. *C. mitchelli* has some points in common with *C. bohemica* of Barrande,[24] particularly in the shape of the cross-section. It differs in not having the ridges studded with tubercles and in the intervening furrows being smooth. The shell surface in *C. mitchelli* is somewhat weathered, and it is possible that tubercles were present, but there is no indication of any on the single specimen examined.

Collected by the late Mr. John Mitchell, after whom the species has been named.

Locality and Horizon. Bowning, near Yass, New South Wales. Upper Trilobite beds, Bowning Series, Upper Silurian.

Collection. Australian Museum. Holotype (F.27005).

Conularia ornatissima Chapman.

1903. *Conularia ornatissima* Chapman, Proc. Roy. Soc. Victoria (N.S.), xvi, 2, p. 341, pl. xxxi, figs. 13–14.

Observations. This Upper Silurian species, described and figured by Chapman, is characteristic amongst Australian species in its small size, extremely wide apical angle of 50°, and outstanding shell ornamentation. The transverse ridges are fine, numerous, and strongly arched. At 10 mm. from the apex of the shell the ridges are 0·2 mm. apart, so that in 10 mm. of shell there would be approximately 60 ridges. On the enlarged portion of the shell (Pl. xxxi, fig. 14) the ridges approximate 60–80 in 10 mm. The intercostal striae are extremely fine, closely packed together, and extend on to the ridges, giving them a tuberculated appearance.

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[24] Barrande.—Syst. Sil., 1867, iii, p. 35, pl. i, figs. 1-9.

Chapman compares this species with *C. nobilis* Barrande from the Upper Ordovician of Bohemia, but points out that it differs considerably in its type of ornamentation.

The only Australian species with which *C. ornatissima* can be compared is *C. chapmani* mihi, but it is at once distinguished by the much wider apical angle, the fine and sharper longitudinal striae in the furrows, and the closeness of the transverse ridges.

Locality and Horizon. In the blue and yellow mudstones at South Yarra (Yarra Improvements), near Melbourne, Victoria. Melbournian Series, Silurian.

Collection. National Museum, Melbourne, Victoria. (1186, 2361.)

Conularia chapmani, sp. nov.

(Plate xxiv, figs. 1–3.)

1877. *Conularia sowerbyi* (?) De Koninck (*non* Defrance), Foss. Pal. Nouv. Galles du Sud, 3, p. 43.

1903. *Conularia sowerbii* Chapman (*non* Defrance), Proc. Roy. Soc. Victoria (N.S.), xvi, 2, p. 340, pl. xxxi, figs. 10–12.

Description. Shell of small size, delicate and tapering more or less uniformly. Apical angle about 26°. Ornamentation fine; transverse ridges well marked (16 in 10 mm.), becoming more crowded at the apex. Aperture and apex unknown. Facial grooves inconspicuous. Marginal grooves not preserved. Ridges cross the face at an angle of 145° to 150° along the median line, and are uninterrupted. Furrows crossed with prominent stout bars, separated by the width of a bar, and extending on to the ridges to form small rounded tubercles. Tubercles are visible only on a close examination of well-preserved portions of shell; otherwise the ridges appear non-tuberculate.

Length of figured specimen 28 mm. Width of face at apertural end of fragment 17 mm.

Observations. Several specimens have been recorded from the Upper Silurian rocks of Australia as the British species *C. sowerbyi.* These in my opinion are not typical of that species, although possessing many points in common with it. Sufficient variation, however, is shown to allow the Australian species new specific rank. *C. sowerbyi* (?) Defrance was recorded with reservation by De Koninck[25] from the Upper Silurian beds of Black Rock Creek near Yass, but was not figured. The specimen, a single small fragment, was afterwards destroyed in the Garden Palace fire of 1882. De Koninck was unable to say positively that this specimen belonged to *C. sowerbyi*, but believed it to be so for two reasons: first, that the ornamentation was very similar, and, second, that it occurred with other species found in association with *C. sowerbyi* in England. De Koninck's record is now of little value, as the specimen is destroyed, there was no figure, and his description is rather meagre. However, as his specimen was collected from the same beds as, and at no great distance from the locality of, *C. chapmani*, I have presumed that they are identical, and have included his reference as a synonym of *C. chapmani* rather than expunge it from Australian literature.

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[25] De Koninck.—Foss. Pal. Nouv. Galles du Sud, 3, 1877, p. 43.

The single specimen of *C. chapmani*, collected from Bowning in the Yass district, although at first glance similar to *C. sowerbyi*, has many points of difference. In *C. chapmani* the ridges are not as tuberculated as in the British species, even allowing for weathering, while the longitudinal bars in the furrows are not nearly in contact laterally. In *C. sowerbyi* the apical angle is much smaller, and doubtless that species attained a much larger size than the Australian form, which from the appearance of the single fragment would not be a large shell.

Chapman records and figures *C. sowerbii* Defrance from the Upper Silurian beds of Victoria, a comparatively broad form which agrees in some respects with the specimen of *C. chapmani* mihi, but differs from the typical *C. sowerbyi*, as a glance at the ornamentation of both those species shows considerable variation. A close examination reveals that Chapman's species is unlike *C. chapmani* in that the ridges are more crowded, there being twice as many ridges in 10 mm. of shell. It agrees more or less in the non-tuberculated nature of the ridges and in the apical angle. These two forms are closely allied and have been placed together until more specimens from the Silurian beds may produce additional evidence.

Notes on the British Species Conularia sowerbyi de Verneuil.

An interesting point in nomenclature has arisen in regard to the well-known British species *C. sowerbyi*. In 1821 Sowerby[26] described *C. quadrisulcata* from four specimens (pl. cclx., figs. 3–6). These included several species from two different geological horizons. Later, in 1824, the name *C. sowerbyi* attributed by de Blainville to Defrance, with a reference to the "Dictionnaire des Sciences Naturelles", was published. Blainville reproduced all Sowerby's six figures, including his *C. teres*, but gave no description, so that Defrance's right to the species is most doubtful. Sowerby, however, in 1821 definitely mentioned that his description of *C. quadrisulcata* was taken from figure 4, of a very excellent specimen, found by the Rev. R. B. Plumtree, of Gloucester, in transition limestone. This specimen had been given to Miller, who in 1793[27] founded the genus *Conularia* on it, but referred to it as a "curious fossil", the class of which had not been determined. This specimen (fig. 4) is undoubtedly the type specimen of *C. quadrisulcata*.

De Verneuil in 1845[28] would restrict Sowerby's name *C. quadrisulcata* to the Carboniferous species, and adopt Defrance's name *C. sowerbyi* for the Silurian species. Slater[29] points out that, "as this description is accompanied by a clear figure, and since this is the first time that the two forms have been definitely separated and named, the species should be assigned to de Verneuil". This is quite inaccurate as shown above, the name *C. quadrisulcata* being absolutely founded on the specimen (fig. 4), a transition limestone species. The name *C. sowerbyi* must be dismissed entirely, as it was given to the two species introduced by Sowerby merely as an alternative name, and therefore it should be restricted to fig. 4 also, and become an absolute synonym of *quadrisulcata*.

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[26] Sowerby.—Min. Conch., iii, 1821, p. 107, pl. 260, figs. 3-6.
[27] Ure.—History of Rutherglen and Kilbride, 1793, pp. 330-331, pl. xx, fig. 7.
[28] De Verneuil *in* Murchison, de Verneuil and Keyserling, Geol. de la Russie d'Europe, 1845, ii, p. 348, pl. xxiv, fig. 5.
[29] Slater.—Monograph of British Conulariae, Palaeon. Soc. ,1907, p. 2.

De Verneuil assigns figures 2*c* and 2*e* of Defrance, or figures 3 and 4 of Sowerby, to *C. sowerbyi*, thereby including the type specimen of *C. quadrisulcata*. In 1855 McCoy[30] points out that the Silurian species should be *C. quadrisulcata*, as the description applied more to the principal specimen (fig. 4) than to any others. He was at first inclined to follow the specific nomenclature of Sandberger, who, in 1847,[31] renounced entirely the name *quadrisulcata* and the still more indefinite *sowerbyi*, and thus on p. 287 used *cancellata*. However, on p. 520, apparently after second thoughts, he used *quadrisulcata*, but unfortunately allotted the name to fig. 5, and then used it for a Carboniferous species.

In Slater's excellent Monograph of the British Conulariae, published in 1907, the type specimen of *C. quadrisulcata* is placed as a synonym of *C. sowerbyi*, while the original figures 5 and 6 of Sowerby are assigned to *Conularia quadrisulcata*. Sowerby's original figure 3 is now a synonym of *C. subtilis* Salter.

Localities and horizons of *Conularia chapmani* are as follows: Junction of the Woori-Yallock and Yarra Rivers, near Melbourne; Wilson's, north of Lilydale, Victoria. Yeringian Series, perhaps younger, Silurian (Chapman). Bowning, near Yass, New South Wales. Upper trilobite beds, Bowning Series, Upper Silurian (Mitchell).

Collection. Australian Museum. (F.28590.) Holotype.

Conularia distincta, sp. nov.

(Plate xxiv, figs. 7–9.)

Description. Shell of medium size, thin, tapering uniformly. Cross section unknown. Faces flat; apical angle about 22°. Marginal grooves not preserved. Facial grooves distinct; aperture and apex unknown. Ornamentation fine; transverse ridges studded with small tubercles, well separated. Ridges arched strongly across the faces (16–18 in 5 mm.), becoming more crowded near the apex and forming an angle of 130°, widening to about 145° towards the apertural end. Ridges undisturbed by facial grooves. Furrows well-marked with longitudinal striations sloping strongly towards the marginal grooves.

Length of fragment 38 mm. Greatest width of face 14 mm.

Observations. This species is represented by a single specimen from the Upper trilobite beds of the Bowning district. The four faces of the shell have been crushed flat and in places are badly wrinkled, but a considerable amount of shell reveals well preserved ornamentation. It is impossible to determine accurately what the cross section was, although the evidence appears to point to its being square. The detailed ornamentation differs from that of *C. chapmani* mihi, the only other Australian species with which it can be compared, in the ridges being placed much closer together, there being almost twice as many in 5 mm. of shell. The striations in the furrows of *C. chapmani* are long, stout, and vertical, whereas in *C. distincta* they are short and slope towards the margins of the shell. The tubercles on the ridges are very minute, and are only preserved on favoured portions of the shell.

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[30] McCoy.—Synops. Brit. Palaeozoic Rocks, 1855, p. 287, 520.

[31] Sandberger.—"Pteropoda der ersten Erdbildungs-Epoche: Conularia und Coleoprion", Neues Jahrb. für Min., etc., 1847, p. 8.

C. distincta is rather an uncommon form so far as the furrow striations are concerned, and there is no other species to my knowledge that it closely resembles. The transverse ridges are very strongly arched near the apex, but the angle becomes less towards the apertural end.

Locality and Horizon. Bowning, near Yass, New South Wales. Upper trilobite beds, Bowning Series, Upper Silurian (Mitchell).

Collection. Australian Museum. Holotype (F.27905).

Conularia warthi Waagen.

(Plate xxiv, figs. 10–11.)

1886. *Conularia* cf. *irregularis* (Kon.) Waagen, Rec. Geol. Surv. of India, xix, p. 26, pl. i, fig. 2 (non *Conularia irregularis* De Koninck).

1891. *Conularia warthi* Waagen, Mem. Geol. Surv. of India (Pal. Indica) (xiii), iv, 2, p. 126, pl. iv, figs. 6*a–d*; pl. v, figs. 1*a–b*.

1912. *Conularia*, sp. nov. (?), cf. *C. warthi*, Glauert, Rec. W. Austr. Mus. and Art Gallery, i, 2, pp. 76–77.

1931. *Conularia* cf. *C. warthi*, Hosking, Journ. Roy. Soc. of W. Austr., xvii, p. 36, pl. xi, figs. 3–6.

1933. *Conularia warthi* Hosking, Journ. Roy. Soc. of W. Austr., xix, p. 57.

Observations. This important Indian species has now been collected from several localities in Western Australia. Described originally from the Lower Speckled Sandstone (Boulder beds) of the Salt Range, its presence has been suspected in Australian rocks for some time, but imperfect material has prevented a definite classification until the last few years.

Glauert in 1912 described three crushed fragments of shell in an ironstone matrix from Byro Station, as *Conularia*, sp. nov (?). He compared his fragments with *C. warthi* Waagen, but refrained from assigning them to that species, as he was unable to find "the fine, somewhat irregular plications that extend transversely over the spaces or valleys between the single ribs", characteristic of the Indian fossil. In 1931 Miss Hosking described and figured some imperfect fragments, identical with those described by Glauert, including specimens showing additional characters. Miss Hosking (p. 37) remarks that: "On one portion where the shelly material is preserved the plications may be seen descending the sides of the ridges, so that it may well be supposed that they are continuous across the valleys between the ridges." In 1933 the same author was able to state definitely that the Western Australian and Indian species are the same. A specimen collected from the Wooramel area showed the rhombic cross section and the typical ornamentation of *C. warthi*, including the row of intercostal tubercles on each side of the lateral furrows.

In the Australian Museum collection is a small suite of fragmentary specimens collected by Mr. H. G. Raggatt from the Gascoyne River. These occur in an ironstone matrix, similar to that described by Glauert, and are associated with crinoid stems. In breaking the ironstone matrix to develop the shell fragments, small portions of beautifully preserved shell were revealed showing delicate ornamentation. The shelly material appears to have been formed of two layers, an outer showing excellent ornamentation, and a thin inner layer revealing distinct granulated ridges, but only indistinct ornamentation in the intercostal areas. On weathered fragments only the studded ridges are shown, the intercostal areas or furrows apparently being quite smooth. The shell is of medium size, tapering slowly and uniformly, the apical angle being small, about 14°. Cross section rhombic. Facial grooves distinct. Marginal grooves narrow and comparatively deep. The ornamentation consists of transverse ridges, strongly arched across the faces, and varying in number according to the position on the shell. On one specimen (Pl. xxiv, fig. 10) the ridges number 14 within the space of 10 mm. at a distance of 50 mm. from the apex, while 20 mm. from the apex they number 20 in 10 mm. The ridges are interrupted in the centre of the faces by the facial grooves, and on their tops are studded with fine tubercles. These are connected with the fine irregular plications which cross the furrows. In all other characters the fragments agree perfectly with the descriptions given by Waagen and Miss Hosking.

The majority of fragments are of small size, but frequently fragments of shell faces reveal a much larger shell. One fragment measured 20 mm. across the face.

Dimensions of figured specimen: Length 50 mm. Greatest width of face 10 mm.

Localities and Horizon. Western Australia: Byro Station, Murchison district (Glauert); two miles E.S.E. of Survey Station R.20; Bogadi Outcamp, 7 miles south of Survey Station R.18; two miles almost east of Survey Station R.20 in cliff on south bank of Wooramel River (Hosking); Gascoyne Junction, near hotel (Raggatt), Windalia Outcamp, Lynden River (Lyons Stage). Byro Stage, Permian.

Collection. Australian Museum. Figured specimen No. F.36551.

Conularia tuberculata, sp. nov.

(Plate xxv, figs. 1–7.)

Description. Shell of medium size, tapering uniformly. Cross section rectangular, faces unequal. Apical angle 15°–23°. Marginal grooves narrow, of medium depth. Facial grooves distinct. Aperture and apex unknown. Ornamentation fine; transverse ridges average about 14 in 10 mm. of shell, arched across the faces at an angle of about 148°. Ridges studded with minute tubercles tapering upward into small points. In the median line the ridges are disturbed by the facial groove and frequently alternate with one another. Furrows are ornamented with fine longitudinal striations, usually well separated.

Dimensions of fragment (F. 28480, figs. 1–2): Length 32 mm. Approximate complete length 90 mm. Width of wide face, 18 mm.; width of narrow face, 11 mm.

Observations. This delicately ornamented species is represented by a small suite of specimens from the Burindi (Lower Carboniferous) beds of New South Wales. An impression of a small fragment of shell from the Willi Willi (Lower Permian) beds of Kempsey is apparently close to this species. It is a characteristic form and easily distinguished by the very unequal faces, the wide face being almost twice the width of the narrow one. The specimens are in a fairly good state of preservation, except for a slight flattening through pressure. This is well marked in Plate xxv, fig. 1, where it can be seen that the ridges on the apertural end have been distorted into very abrupt curves. After allowing for a certain amount of flattening the faces are markedly unequal, with a distinct rectangular cross section. The average number of ridges in 10 mm. appears to be about 14, although in one specimen (fig. 4), a fragment from the extreme apical region, the ridges approximate 30 within 10 mm. of shell. The ridge crests are studded with minute tubercles, fairly close-set, which taper upwards to form sharp points, and these occasionally may be slightly hooked. The ridges cross the faces at angles of approximately 148°, although in figure 2 it will be noticed that the straight sides of the chevrons have been replaced by simple curves. This character is not constant, and is probably due to pressure and slight distortion. In well-preserved portions of the shell the longitudinal striations in the furrows are plainly distinguished. These extend right across the furrow and are not in contact laterally. In badly weathered shells the striae in most cases are indistinguishable, or maybe absent altogether, and the furrows appear smooth. In one very small fragment of shell from Kempsey, New South Wales, the striae are particularly noticeable. This fragment is associated in the matrix with *Productus brachythaerus* Sowerby and *Strophalosia gerardi* King, collected from the Willi Willi beds of the Macleay Series. These have been designated recently by Mr. A. H. Voisey as being Permian in age, so that in all probability *Conularia tuberculata*, which is not uncommon in the Carboniferous beds of New South Wales, also extends into the Permian.

There is no other Australian species of *Conularia* that can be compared with *C. tuberculata.* The tuberculated nature of the ridges, the longitudinal striae in the furrows, and the comparatively small size of the shell make it an unmistakable species.

Localities and Horizon. Bramble's Farm, Myall Lakes; Clarencetown; Taree; New South Wales, Lower Carboniferous. Kempsey, New South Wales, Lower Permian.

Collection. Australian Museum. Figured specimens: Pl. xxv, figs. 1–2 (F.28480); fig. 3 (F.29019); fig. 4 (F.25178); fig. 5 (holotype, F.29022); figs. 6–7 (F.36583).

Conularia expansa, sp. nov.

(Plate xxv, figs. 8–9.)

Description. Shell of large size, broad, and tapering uniformly. Apical angle 29°–32°. Cross section square (?). Marginal grooves narrow, shallow. Central facial groove well-marked. Aperture and apex unknown. Ornamentation fine. Ridges prominent, 12–13 in 10 mm., forming a broad curve across the face, uninterrupted by the facial groove and apparently continuous across the marginal groove. Ridges studded on their crests with small tubercles (3–4 in 1 mm.). Furrows about twice the width of the ridges and perfectly smooth.

The total length is estimated to be about 160 mm. Greatest width of face 55 mm.

Observations. The outstanding feature of *Conularia expansa* is the wide apical angle, together with its large size and definite type of ornamentation. There is only one example of this species, but it is exceptionally well preserved and shows an almost complete face. This specimen is from the Lower Carboniferous beds of Clarencetown, New South Wales, and is by far the largest of the Australian Carboniferous Conulariae. There are not many species with which the present form can be compared. Its closest resemblance is with *Conularia quadrisulcata* Sowerby, a British Carboniferous species attaining a length of over 200 mm., and with the same type of ornamentation. De Koninck[32] records *C. quadrisulcata* from Buchan, on the Gloucester, where it was found in a brownish argillaceous limestone, but his specimen was unfortunately lost in the Garden Palace fire of 1882. De Koninck mentions that with a lens one can see irregular transverse striae at the bottom of the furrows; the apical angle is 20°, and there are 24 ridges in 10 mm. of shell. He also states that his single specimen is rhomboidal in cross section. These characters do not entirely agree with the description of the typical *C. quadrisulcata* as defined by Slater,[33] so that there must remain a certain amount of doubt whether the Australian shell was the same as the British species. *Conularia expansa* differs from *C. quadrisulcata* in possessing a far greater apical angle (30°). In the latter it is 12°–14°. The curved ridges are also a distinctive character in the Australian species, as the specimen has received, apparently, very little distortion in its preservation.

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[32] De Koninck.—Foss. Pal. Nouv. Galles du Sud, 1877, 3, p. 173.

The ridges for the most part are uninterrupted by the central facial groove, and are continuous across the marginal grooves, except for a slight upward tendency. *Conularia expansa* is closely allied with *Conularia acutilirata*, from the Middle Permian beds, in shape and size, but differs in the ridges possessing tubercles and in the smooth furrows. In *C. acutilirata* another point of difference is the wide marginal furrows with the interlocking of the ridges.

Locality and Horizon. Clarencetown, New South Wales. Burindi beds, Lower Carboniferous.

Collection. Australian Museum. Holotype (F.36606).

Conularia torta McCoy.

1847. *Conularia torta* McCoy, Ann. Mag. Nat. Hist., xx, p. 306, pl. xvii, figs. 9–10.
1849. *Conularia torta* Dana, Wilkes' U.S. Explor. Exped., Geology, x, p. 710.

McCoy's original description of this species is as follows: "Very elongate-conic, diminishing in diameter at the rate of one line in two inches; section oval; lateral longitudinal channels only two (?), placed with a slight obliquity to the long axis of the shell, giving it a twisted appearance, being placed at the sides (or extremities of the short axis) of the oval section at the base, and being at the ends (or extremities of the long axis) of the oval section near the small end; sides very convex without mesial furrow; transverse sulci coarse (about fifteen in half an inch), continued uninterruptedly across from one side furrow to the opposite."

McCoy records this species as being not uncommon in the Upper Permian sandstone of Muree, New South Wales, but to my knowledge it has not been collected since, although a good deal of collecting has been done in that area. The description given by McCoy of this extraordinary form, from two specimens, shows many modifications from the typical members of the group. Dana remarked on McCoy's description of this species of *Conularia* from Muree, and its having but two longitudinal furrows (articulating sutures). It is quite possible that additional specimens may prove *Conularia torta* to be a true Pteropod shell and distinct from the Conulariae. At present it must be considered a doubtful species of *Conularia*.

Locality and Horizon. Sandstone at Muree, New South Wales. Upper Marine Series, Upper Permian.

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[33] Slater.—"A Monograph of the British Conulariae", Palaeon. Soc., 1907, p. 25.

Conularia levigata Morris.

(Plate xxv, figs. 10–13; Plate xxvi, fig. 4.)

1845. *Conularia levigata* Morris *in* Strzelecki's Phys. Desc. of New South Wales, p. 290, pl. xviii, fig. 9*a*, *b*.
1849. *Conularia levigata* Dana, Wilkes' U.S. Explor. Exped., Geology, x, p. 710, pl. x, fig. 9.
1877. *Conularia laevigata* De Koninck, Foss. Pal. Nouv. Galles du Sud, p. 313, pl. xxiii, fig. 1.
1886. *Conularia laevigata* Waagen, Rec. Geol. Survey of India, xix, p. 25, pl. i, fig. 1.
1886. *Conularia laevigata* Johnston, Proc. Roy. Soc. Tasmania (1887), p. 18.
1891. *Conularia laevigata* Waagen, Mem. Geol. Survey of India, Salt Range Fossils, iv, 2, p. 123, pl. iv, figs. 5*a–g*; pl. iii, figs. 1*a–b*, 2*a–b*.
1911. *Conularia* cf. *laevigata* Laseron, Journ. and Proc. Roy. Soc. of N. S. Wales, xlv, p. 247, pl. xi.

The original description given by Morris of this species is as follows: "Shell smooth, elongate, pyramidal, rectangular, gradually decreasing, two of the faces larger than the other two; faces slightly concave, longitudinally sulcated at the lateral angles, ornamented with equal transverse ridges, forming a slightly obtuse angle in the mesial furrow, where they alternate with each other; ridges terminating at the bottom of the lateral channels, curving slightly upwards, and alternating with each other, producing a slightly granulated ridge."

Observations. Salter[34] in 1866 described a species of *Conularia* from North Wales as *C. laevigata.* This name was pre-occupied by Morris in 1845 for the Australian species. In the introduction of this paper it was suggested that the British species be renamed *C. salteri.*

Morris in describing *C. levigata,* stated that the shell was rectangular in cross section, two of the faces being larger than the other two, and the number of ridges within the space of half an inch of shell numbered 16. Dana, in 1849, described this form from Harper's Hill, and stated that the sides are subequal, the larger face in one individual measuring six-tenths of an inch, the smaller face fifty-six-hundredths of an inch. He also adds: "The form of this species in the specimen before us is but slightly convergent, except at the summit. . . . There are 14 to 16 plications in half an inch; and the plicae are smooth, without markings of any kind. No Conulariae were observed in Illawarra, to which region this species is accredited by Strzelecki."

Waagen, in characterizing *C. laevigata* from the boulder- group of the Eastern Salt Range, stresses that the most striking characters, which always hold good in this species, are: first, the rectangular, not quadratic section of the shell; second, the always smooth condition of the ribs, and the very regular distribution of these, so that always ten to twelve can be counted within the distance of 10 mm.

In a large series of specimens, from many localities in New South Wales, the cross section of this species appears to be almost square, with a slight tendency towards rectangularity in some instances. In the type specimen the cross section is rectangular, with faces in proportion of four to five. Dana's figured specimen has almost equal faces, while Laseron's specimen, identified as *Conularia* cf. *laevigata*, which I have assigned to this species, has almost equal faces. The Indian species, according to Waagen, are more inclined to a rectangular cross section and not quadratic.

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[34] Salter, J. W., *in* Ramsay's Geol. N. Wales, Mem. Geol. Surv., iii, ed. 1, p. 354, woodc. 19 (also ed. 2), 1881, p. 562.

There is a good deal of variation in the arrangement of ribs. Morris stated in his description that the transverse ribs alternate with each other at the mesial furrow. This feature is not consistent, and it has already been pointed out by Waagen that "sometimes, however, in one and the same specimen, they do not alternate, but unite directly with each other, and then form simply bent lines". This is found in the Australian specimens, where in occasional well-preserved specimens the ribs are uninterrupted across the faces.

Laseron, in 1911, described and figured a specimen from the Lower Permian of the Maitland district as *Conularia* cf. *laevigata* of Morris. After a careful examination I can find no reason to distinguish this specimen from *C. levigata*. Laseron pointed out that the only difference was in the relative proportions of the walls. In his specimen the four sides are practically equal, whereas he considered *C. levigata* as strictly rectangular in cross section.

Conularia levigata is apparently a rather common species in the Lower Marine rocks of the Australian Permian, although several specimens have been recorded from the Upper Marine beds. Morris recorded the species from the Lower Marine of Raymond Terrace and from the Upper Marine of Illawarra. Dana records it as being abundant at Harper's Hill, while De Koninck records the Rev. W. B. Clarke as having found it at Black Creek and in the Muree sandstones.

There cannot be much doubt about the determination of this form. It differs from *C. inornata* of Dana by its almost square cross section, compared with the extreme rectangular cross section of that species. The apical angle is small in *C. levigata*, and it appears that the species must have attained a considerable size. The specimen figured on Plate xxvi, figure 4, has a length of 150 mm. The greatest width of the face is 22 mm. The affinities of *C. levigata* with other species have been dealt with by earlier authors.

Localities and Horizon. New South Wales: Farley; Raymond Terrace; Harper's Hill; Ravensfield; Greta; Jackson Hill, Cessnock; Pokolbin. Tasmania: River Styx; Porter's Hill. Lower Marine Series, Permian. New South Wales: Ulladulla. Upper Marine Series, Permian.

Collection. Australian Museum. Figured specimens: Plate xxv, fig. 10 (F.25779); fig. 12 (F.25780); fig. 13 (F.36590). Plate xxvi, fig. 3 (F.36588).

Conularia inornata Dana.

(Plate xxvi, figs. 2, 5, 8.)

1849. *Conularia inornata* Dana, Wilkes' U.S. Explor. Exped., Geology, x, p. 709, pl. x, fig. 8 (Atlas).

1877. *Conularia inornata* De Koninck, Foss. Pal. Nouv. Galles du Sud, 3, p. 176, pl. xiv, fig. 22.

Description. Shell large, varying considerably in size; tapering slowly and uniformly. Cross section rectangular. Faces unequal; the narrow faces two-thirds the width of the wide ones. Apical angle about 12°–14°. Marginal grooves wide and shallow, a definite groove being formed at the base by the ends of the transverse ridges. Aperture unknown, apex pointed. Ornamentation coarse; transverse ridges finely edged, widely separated (10 to 12 within 10 mm. of shell), forming an angle of about 150° down the centre of each face. Ridges become more crowded towards the apex of the shell. Facial groove central and distinct, interrupting the transverse ridges so that they occasionally alternate with each other. In the marginal furrows the ridges arch strongly upwards and interlock with each other, forming a distinct raised ridge in the centre of the marginal groove. Furrows smooth.

Length of largest specimen in Australian Museum collection (F.6413), figured on Plate xxvi, figure 2, is about 305 mm. Greatest width of face 32 mm.; small face 24 mm.

Observations. Dana's original description of this species is as follows: "Large, adjoining sides very unequal, smaller three-quarters the breadth of larger. Plicae remote (ten to half an inch), naked, smooth (?); angle of convergence 12°."

The type specimen of this species was collected from the Upper Marine beds of Glendon, New South Wales, and is at present housed in the United States National Museum, Washington, U.S.A. A plaster cast proves it to be nearly three inches in length. The greatest width of the wide face is 28 mm., the narrow face 23 mm. Dana in his description gives the dimensions of the faces at the smaller extremity, three-quarters and nine-tenths of an inch; at the larger extremity, nine-tenths and one inch and two-tenths. The cast shows the specimen to be in a very poor state of preservation. The marginal grooves are poorly preserved, and the faces are badly weathered, almost to the exclusion of any ornamentation. Dana stated that "it is impossible to determine whether the surface of the ridges were quite smooth or crenulated, though it is apparent they could not have been regularly crenulated". The ridges are quite smooth in this species and the furrows are not ornamented.

De Koninck gave a more complete description of *C. inornata* in 1877, when he described a single specimen found by the Rev. W. B. Clarke in a dark grey micaceous sandstone about one and a half miles from Maitland. From one of the fragments De Koninck estimated the length to have been at least 400 mm., although the diameter of the base was only 40 mm. The four faces were depressed in Clarke's specimen (since lost in the Garden Palace fire of 1882), a feature common in most specimens of this species.

Conularia inornata is a not uncommon species in the Upper Marine beds of New South Wales, but is rare in the Lower Marine beds. A good series is represented in the Australian Museum collection, embracing large specimens of over 300 mm. and smaller or juvenile shells measuring about 90 mm.

There has always been a certain amount of confusion over the two species *C. inornata* and *C. levigata.* There is no doubt that they are closely allied and bear a strong resemblance to one another. In both species there is a considerable amount of variation in the number of ridges, which are approximately the same within 10 mm. of shell. The two main points of difference are the extreme rectangular cross section of *C. inornata* and the distinctly raised ridge in the marginal furrows. The apical angle is also wider than in *C. levigata.*

Dana recorded the species from Glendon, while the Rev. W. B. Clarke found it near Maitland in the Newcastle district. Johnston[35] records it doubtfully from the Lower Marine beds of Tasmania. It is strange that this common

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[35] Johnston.—Syst. Acc. Geology Tasmania, 1888, p. 116.

Australian species has not been found in the Salt Range beds associated with *C. levigata* and *C. tenuistriata*. It is possible that this species may yet be found in the Indian Permian.

Localities and Horizon. New South Wales: Harper's Hill, Farley, Lower Marine Series, Permian. Shoalhaven, Kiama, Branxton, Capertee, Richmond Vale, Upper Marine Series, Permian.

Collection. Australian Museum. Plate xxvi, fig. 2 (F.6412); fig. 5 (F.36597); fig. 12 (F.36596).

Conularia tenuistriata McCoy.

(Plates xxvi, figs. 7, 8, 10, 11, 14.)

1847. *Conularia tenuistriata* McCoy, Annals and Mag. Nat. Hist., xx, p. 307, pl. xvii, figs. 7–8.

1877. *Conularia tenuistriata* Koninck, Foss. Pal. Nouv. Galles du Sud, ii, p. 310, pl. xxiii, fig. 2.

1886. *Conularia tenuistriata* Waagen, Records Geol. Survey of India, xix, 1, p. 26, pl. i, fig. 3.

1891. *Conularia tenuistriata* Waagen, Mem. Geol. Survey of India (Pal. Indica), iv, 2, p. 125, pl. v, figs. 2–3.

Observations. This species, which is comparatively rare in Australian rocks, is characterized by possessing a rhomboidal cross section and fine transverse ribs; these are closely set together, approximating 27 to 29 within the space of half an inch of shell. It has marked unequal faces, while the furrows are ornamented with longitudinal striae, seen only in well-preserved portions of the shell.

McCoy in 1847 described this species from the Upper Marine micaceous sandstone of Muree, New South Wales, where it was said to be not uncommon, but to my knowledge very few specimens have been collected since that date. In his original description, McCoy stated that the cross section was rhomboidal, with decided unequal faces; two narrow faces flat, or slightly convex, about half of the width of the two wides ones, which are slightly concave. He also stated: "The transverse striae are very fine, twenty-seven to twenty-nine in the space of half an inch, passing uninterruptedly with a slight upward curve, across the broad faces, more nearly straight on the two narrow ones." He gives the dimensions of one specimen, imperfect at both ends, and measuring one and a half inches long, as follows: "Long diameter at base 9 lines, the short diameter at base 4½ lines; long diameter smaller end 6½ lines, short diameter at ditto 3 lines."

This description defines an outstanding type of *Conularia*; one that has a strongly rectangular cross section, or rhomboidal, and with twenty-seven to twenty-nine transverse ribs within half an inch of shell.

De Koninck in 1877 described a further specimen from the type locality which differed from McCoy's specimen in having only nineteen ribs to 10 mm. of shell. The cross section was the same. De Koninck pointed out that the furrows are striated in the direction of the main axis.

Waagen, in recording this species from the Salt Range beds of India, pointed out "the difference of breadth between the two sides of the shell is not quite as strong as in the Australian ones, the narrower side being slightly more than half the breadth of the broader one". He also stated "the number of ridges are not quite in accordance with McCoy's indications, who counts 27 to 29 within the space of half an inch". Diener in 1899 is doubtful whether the Indian specimens ought to be identified with McCoy's species, because of the difference in shape of the cross-section. In the Salt Range form the narrow sides of the shell are nearly two-thirds the breadth of the broader ones, and seventeen to twenty ribs are counted within the space of 10 mm. As far as the ribs are concerned there is only a slight variation, as in McCoy's specimen, which shows twenty-seven to twenty-nine ribs in half an inch, would possess twenty-two to twenty-three ribs within the space of 10 mm. The variation in the number of ribs is explained by Waagen.

Conularia tenuistriata is uncommon in Australian rocks and the material for examination is poor. In the suite of specimens examined there is a considerable amount of variation both in the shape of the cross section of the shells and in the number of ribs within a given space. The rhomboidal section does not appear to be constant, and I think it quite possible that this character may be caused by deformation of the shell. The majority of specimens have a rectangular cross section.

A single fragment of shell from Kashmir was referred by Diener[36] to *Conularia tenuistriata* McCoy, but Cowper Reed in 1936[37] placed this form as being identical with his new species of *C. punjabica*.

The typical *C. tenuistriata* may be distinguished by the strong rhomboidal or rectangular cross section and a very small apical angle, which gives the specimens an extremely elongated appearance. Faces concave. In the Australian specimens it is difficult to detect longitudinal striae in the furrows, although several specimens reveal a faint indication of them. De Koninck found them on his specimen from Muree.

De Koninck recorded *C. tenuistriata* from the type locality. It has also been recorded with some doubt from the Gympie beds of Queensland by R. Etheridge, junr. Waagen recorded it as being rare in the Salt Range beds, while Cowper Reed described a few specimens from a "*Conularia* zone" one foot thick in the Olive Series, above the Boulder bed and the Eurydesma zone of the Salt Range.

The typical *C. tenuistriata* has been collected from the Lower Marine and Upper Marine beds.

Localities and Horizon. New South Wales: Pokolbin; Ravensfield; Lower Marine Series. Muree; Raymond Terrace; Upper Marine Series.

Collection. Australian Museum. Plate xxvi, figs. 7, 8 (F.25782); figs. 10, 11 (F.26103); fig. 14 (F.20570).

Conularia acutilirata, sp. nov.

(Plate xxvi, fig. 1.)

Description. Shell of large size, moderately thick, tapering uniformly and fairly abruptly. Cross section rhombic. Faces equal, flat; apical angle 23°. Marginal grooves wide, shallow. Ornamentation very distinct; strong bladed transverse ridges (13 in 10 mm. of shell) arch gently across the face, meeting in the centre at an angle of about 157°. Ridges interrupted by a distinct facial groove, and often alternate, otherwise continuous. In the marginal grooves the ridges trend sharply upwards and interlock with those of the adjacent face, tapering away as they pass the median line of the groove. The furrows are wide, usually smooth, although traces of longitudinal striations or wrinkling may be seen near the proximal end.

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[36] Diener.—Mem. Geol. Survey of India, 1899 (Pal. Indica) (xv), i, 2, p. 18, pl. vii, fig. 6.

[37] Cowper Reed.—Mem. Geol. Survey of India, 1936 (Pal. Indica) (N.S.), xxiii, Mem. 1, p. 31.

Length of described specimen 125 mm. Greatest width of face 45 mm. Calculated length approximately 220 mm.

Observations. Two well-preserved examples of this species, both from the Upper Marine beds of the Middle Permian, were collected at Branxton and Maitland, New South Wales. The ridges show little or no distortion from pressure, and it would appear that the rhombic cross section is the natural one. I can find no traces of tubercles on the ridges. Originally the ridges must have terminated in finely bladed edges, slightly overhanging the furrows towards the apex of the shell. The edges have been broken and shattered and at first glance have a somewhat tuberculated appearance. On several parts of the shell, particularly near the apertural end, longitudinal striae are visible on the sloping surface of the ridges, extending well into the furrows. For the most part the furrows are perfectly smooth. In one specimen no traces of longitudinal striae are visible in the furrows. This comparatively large form is an outstanding species amongst the Australian Conulariae and cannot be confused with any existing species. It differs from *C. inornata* Dana, in its wide apical angle and rhombic cross section. It also possesses points of resemblance with *C. expansa* from the Carboniferous rocks, as far as dimensions are concerned, but does not possess the finely tuberculated ridges. The marginal grooves in *C. acutilirata* are much wider than in *C. expansa*, a species in which they are narrow and continuous. The method of the interlocking ridges is similar to that found in *C. quadrisulcata* Sowerby from the Carboniferous of England, but in that species the ridges are strongly tuberculated, the apical angle is smaller and the cross section is square.

Localities and Horizon. Branxton, near Maitland; East Maitland Company's shaft, near Farley, New South Wales. Upper Marine Series, Permian.

Collection. Australian Museum. Figured specimen F.36205.

Conularia crenulata, sp. nov.

(Plate xxvi, fig. 15.)

Description. Shell of medium size, tapering uniformly and slowly. Cross section a rhomb, with equal faces and flat, except for a slight convexity towards the facial grooves. Apical angle 11°–12°. Marginal grooves of medium depth and width, rounded. Facial grooves distinct, not interrupting the transverse ridges. Ornamentation consists of very fine ridges with wide furrows. No trace of any striae on furrows. Ridges moderately close (average 14 within 10 mm. of shell), arched across the face at a fairly wide angle, and crenulated to a marked degree. In the marginal grooves the ridges trend upwards, and although they alternate with the ridges of the adjoining face rarely overlap.

One specimen, approximately 120 mm. in length, has a facial width at the apertural end of 28 mm.

Observations. It is with some hesitation that this specimen is described as a distinct form. The crenulated nature of the ridges appears to be too constant and regular to have been caused by distortion, while in the same matrix and at no great distance from the specimen in question a fragment of *C. levigata* Morris shows no distortion of the ridges at all. It is distinct from all other Australian species in the crenulated nature of the ridges. In outline this species resembles *C. acutilirata* mihi, but differs in the smaller apical angle; the marginal grooves are deeper and narrower in *C. crenulata.* The specimen is badly weathered, but it appears as if the furrows were ornamented with marked longitudinal striae.

Locality and Horizon. New South Wales: Farley. Lower Marine Series, Permian.

Collection. Australian Museum. Plate xxvi, fig. 15 (F.3137).

Conularia derwentensis Johnston.

(Plate xxvi, fig. 9.)

1886. *Conularia derwentensis* Johnston, Proc. Roy. Soc. Tasmania (1887), p. 17.
1888. *Conularia Tasmanica* Johnston, Syst. Acct. Geol. of Tasmania, pl. xx, fig. 1.

The original description given by Johnston is as follows: "Shell quadrangular, pyramidal; section rectangular; apical angle of larger sides about 25 deg., relation of the two larger sides to the two small ones, nearly as 4 to 3; faces flat or very slightly convex. A strong longitudinal furrow runs down each of the lateral angles, and a faintly marked one longitudinally divides each face into two equal parts; transverse thread-like riblets gently symmetrically arched on each face, sometimes interrupted and alternate at the point where they are intersected by the faint mesial longitudinal furrow, but generally continuous; riblets coarser and more distant than in *C. laevigata*; gradually increasing in density from base to apex; near the latter there are 10 in the space of 10 mm., near the base there are only 5 to 6 in the same space. It is evident that the riblets were minutely granulated as the upper riblets still preserve this character, together with fine vertical striae in the interspaces. In the lateral channels the riblets bend abruptly towards apex, and become interrupted and alternate at junction with the riblets of the succeeding face. Sides gently sloping inwards near basal margins.

"Length of perfect specimen, 5¼ inches; greatest diameter, 49 millimetres by 37 millimetres."

Observations. Johnston prepared the above description apparently from two specimens in the collection of the Tasmanian Museum, but unfortunately did not figure them. The author pointed out that the species is readily distinguished from *C. tenuistriata* and other forms by its much wider apical angle. He also stated that Waagen had recently figured a portion of a similar form from the Olive Series of the Salt Range, India, where it is associated with *C. laevigata* and *C. tenuistriata* as in Tasmania. This Indian form is presumably *Conularia* cf. *irregularis* of Koninck, recorded by Waagen,[38] but later described by him as *Conularia warthi.* In the original description Waagen stated that this form had an apical angle of 25° and possessed granulated ridges with striated furrows, which agreed somewhat with Johnston's *C. derwentensis.* However, with the advent of further specimens, Waagen in 1891, when describing *C. warthi,* included *C.* cf. *irregularis* Waagen as a synonym and revised his description. *C. warthi* has an apical angle of 12°, with 11 to 16 ridges within 10 mm. of shell. The four faces are equal in breadth, so that any relationship with *C. derwentensis* must be dismissed.

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[38] Waagen.—Rec. Geol. Survey of India, 1886, xix, p. 26, pl. i, fig. 2.

Johnston in 1888[39] published a list of species of *Conularia* occurring in Tasmania. These included *C. inornata, C. laevigata, C. tenuistriata, C. torta* and *C. derwentensis*, the latter his own species. *C. inornata* (?) was recorded from the Upper Marine beds, while the other species were recorded from the Lower Marine beds, with the exception of *C. laevigata*, which had been collected from both. On pl. xx of the same publication Johnston figured a specimen (fig. 1) which he called *C. tasmanioa* (allied to *C. inornata*). This specimen agrees perfectly with Johnston's description of *C. derwentensis*, is alike in dimensions, and both were collected from the Lower Marine beds of Bridgewater. *C. tasmanicd* was not listed on p. 116, and is not mentioned elsewhere, so that it appears evident that *C. tasmanica* was printed in error for *C. derwentensis.*

C. derwentensis differs markedly from *C. inornata* in its very coarse, and sparseness of, transverse ribs within 10 mm. of shell and in its wide apical angle. It has points of resemblance with *C. expansa*, a Lower Carboniferous species, but is distinguished by the longitudinal striae in the furrows of *C. derwentensis* and in the number of ridges. It is an unmistakable species among Australian Conulariae. The figured specimen from Mount Wellington agrees perfectly with Johnston's figured specimen, and agrees similarly with the description of *C. derwentensis.* On well-preserved portions of the shell the granulated ridges and longitudinal striae in the furrows are plainly visible. The dimensions are practically the same as those described by Johnston.

Locality and Horizon. Near Mount Wellington, Tasmania. Lower Marine Series, Permian.

Collection. Australian Museum. (F.36630.)

EXPLANATION OF PLATES.

Plate XXIV.

Conularia chapmani, sp. nov.

Fig. 1.—Holotype showing one face of shell imbedded in matrix. Bowning, near Yass, N.S.W. Natural size.

Fig. 2.—An enlarged portion of the same shell showing ornamentation.

Fig. 3.—Microphotograph of holotype showing ornamentation.

Conularia mitchelli, sp. nov.

Fig. 4.—Holotype from Bowning, near Yass, N.S.W. Natural size.

Fig. 5.—Transverse section of the same shell at its widest point. Natural size.

Fig. 6.—Microphotograph showing fine ornamentation.

Conularia distincta, sp. nov.

Fig. 7.—Crushed specimen from Bowning, near Yass, N.S.W. Holotype. Natural size.

Fig. 8.—Enlarged portion of face impression, showing longitudinal striae in furrows.

Fig. 9.—Enlarged portion of face showing fine tubercles on the transverse ridges.

Conularia warthi Waagen.

Fig. 10.—Impression of two faces of an imperfect specimen from the Gascoyne River, Western Australia. Natural size.

Fig. 11.—A small fragment of shell showing ornamentation. Enlarged.

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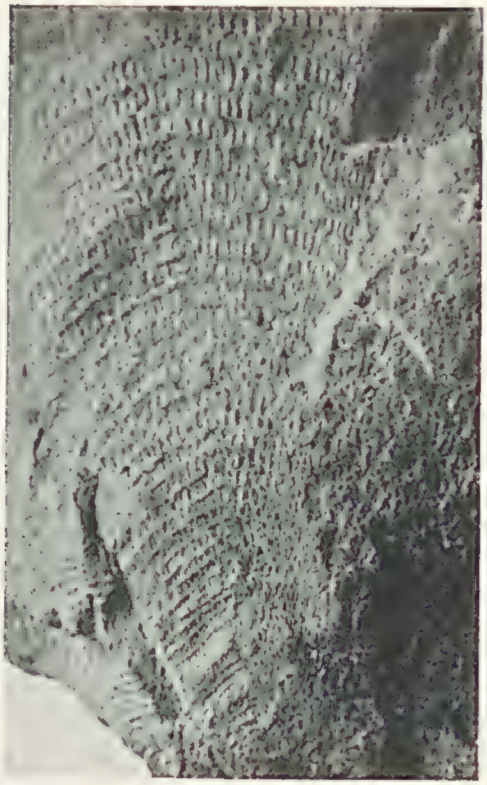
[39] Johnston.—Syst. Acct. Geol. Tasmania, 1888, p. 116.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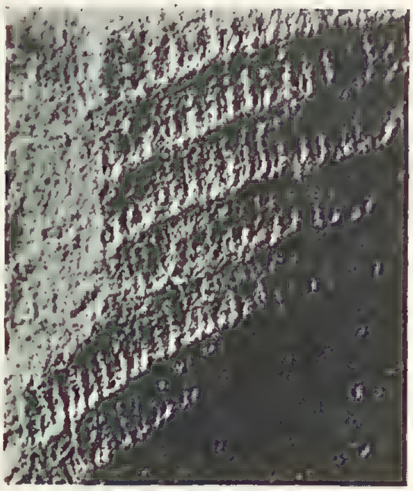
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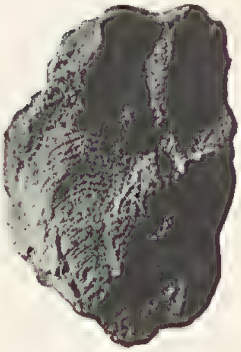
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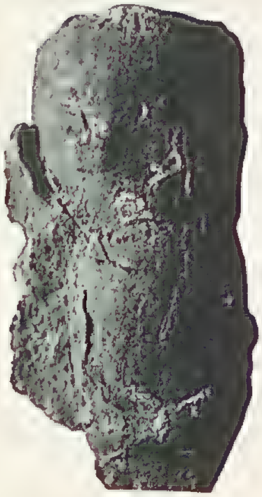
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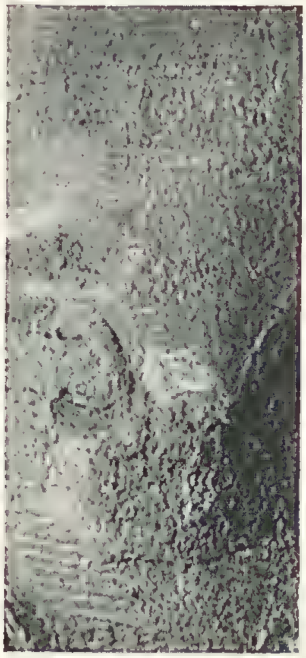
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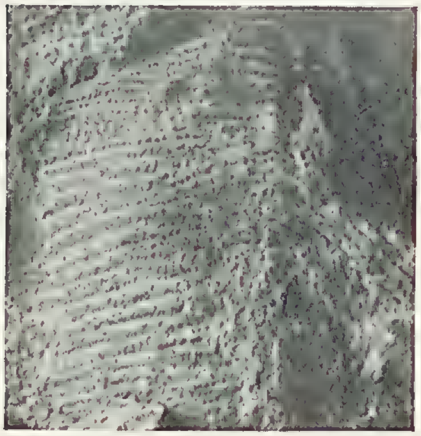
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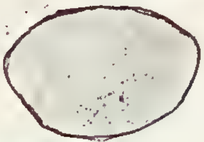
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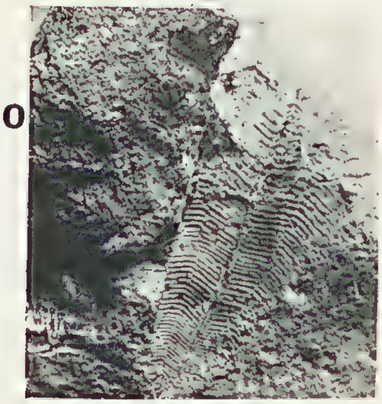
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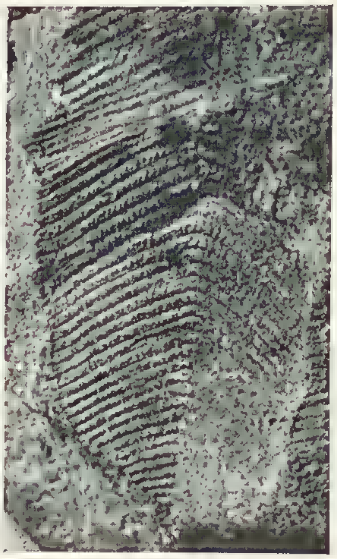
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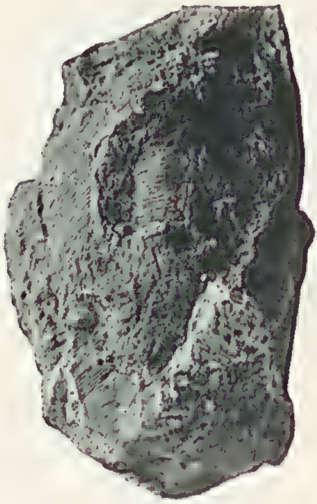
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G. C. CLUTTON, photo.

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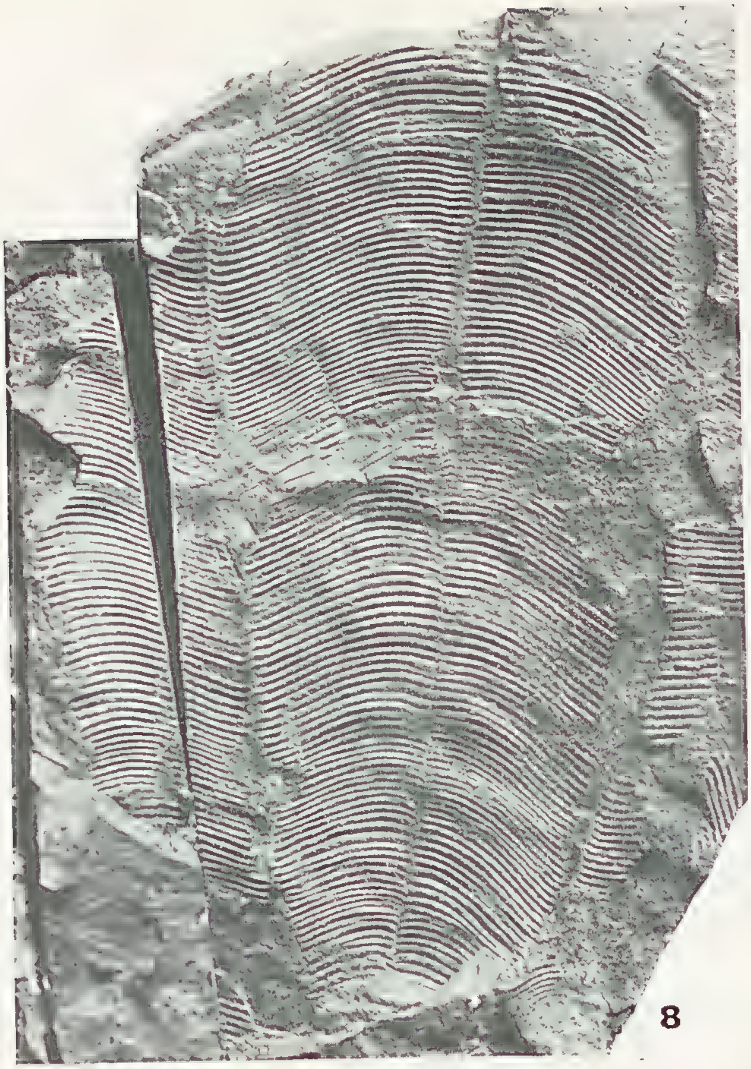
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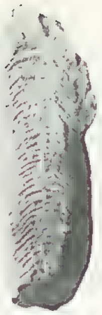
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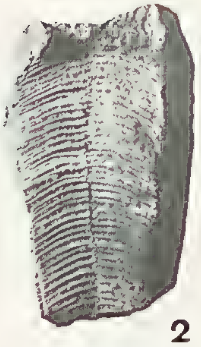
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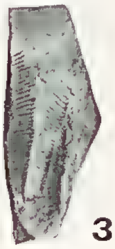
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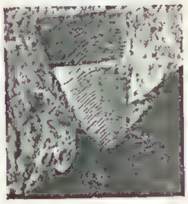
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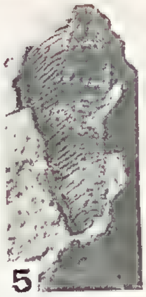
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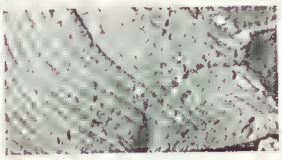
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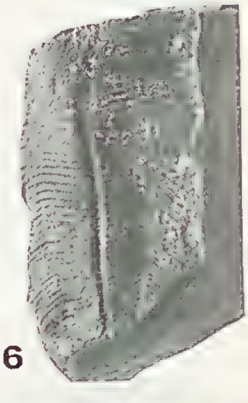
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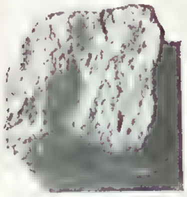
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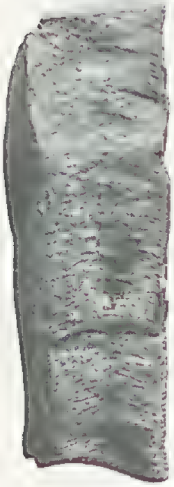
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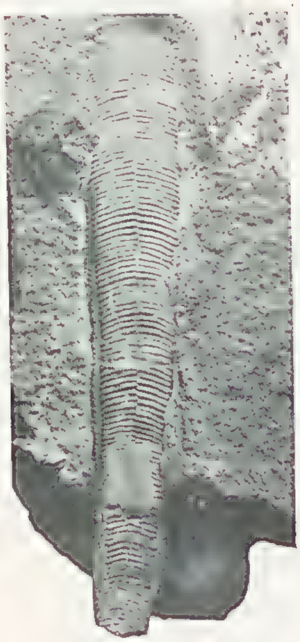
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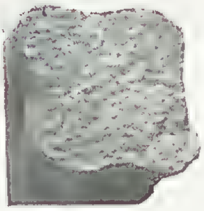
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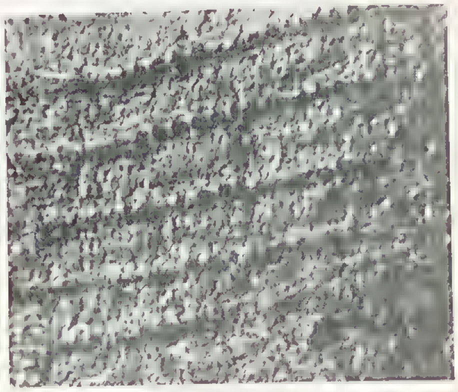
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G. C. Clutton, photo.

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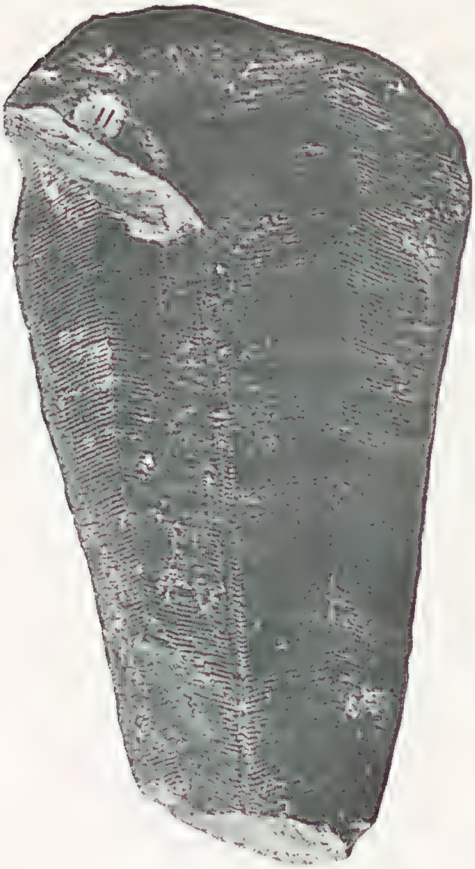

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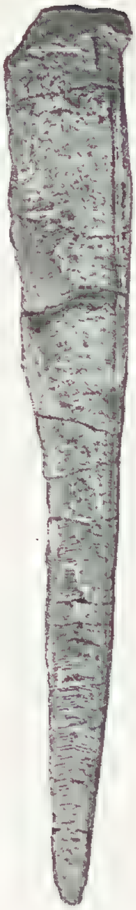

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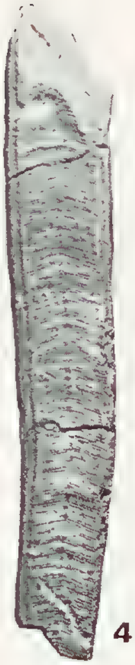

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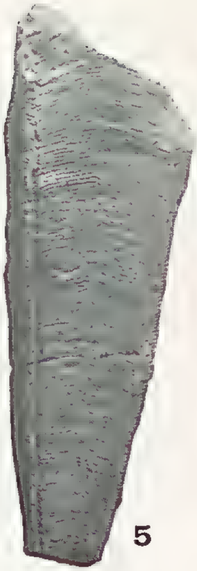

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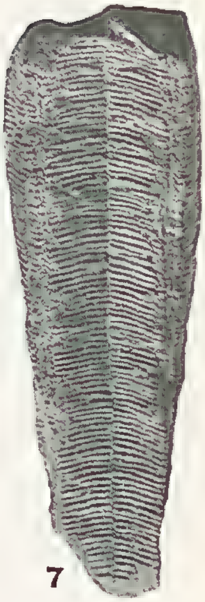

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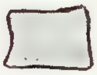

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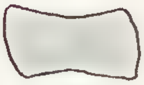

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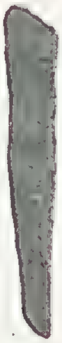

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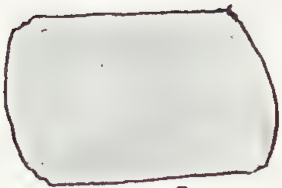

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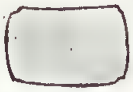

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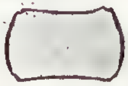

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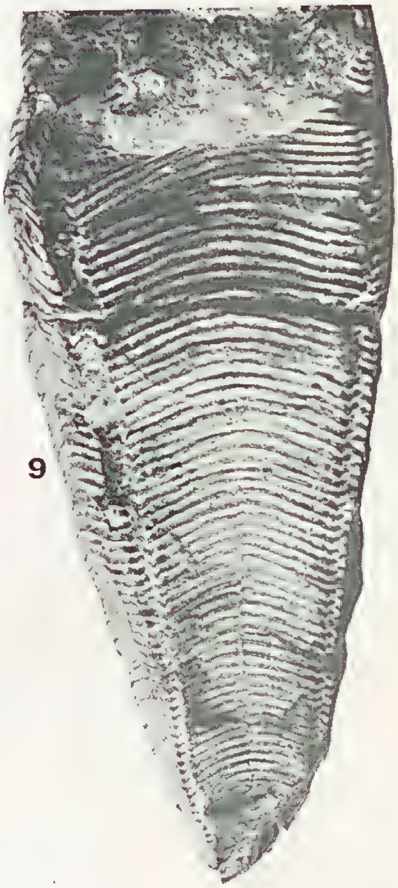

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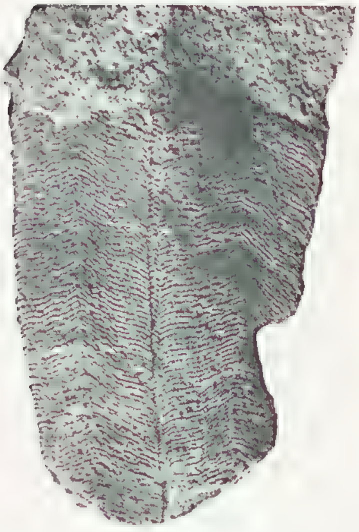

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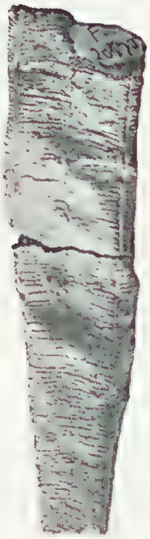

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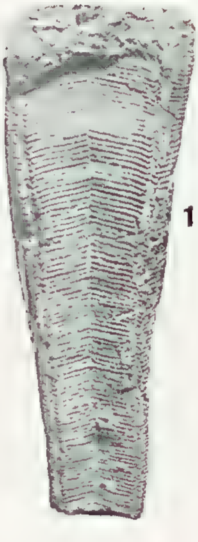

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G. C. CLUTTON, photo.

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PLATE XXV.

Conularia tuberculata, sp. nov.

Fig. 1.—An imperfect specimen; wide face showing ornamentation. Natural size.

Fig. 2.—The narrow face of the same specimen. With a lens the tubercles and longitudinal striae are visible. Natural size.

Fig. 3.—A small weathered example of a single face showing tubercles. Natural size.

Fig. 4.—A fragment of shell from the apical end. Ridges very numerous. Ornamentation only visible on impression of inner face. Natural size.

Fig. 5.—Holotype from Bramble's Farm, Myall Lakes, N.S.W. Natural size.

Fig. 6.—A large specimen showing tubercles and striae in furrows. Natural size.

Fig. 7.—A microphotograph of portion of fig. 6, showing tubercles on the transverse ridges. Striae are not shown to advantage.

Conularia expansa, sp. nov.

Fig. 8.—A slightly enlarged impression of a single face, showing wide apical angle and marginal junctions.

Fig. 9.—A small fragment of shell showing tubercles and smooth furrows. Slightly enlarged.

Conularia levigata Morris.

Fig. 10.—Portion of a large specimen, approximately two-thirds natural size.

Fig. 11.—Transverse section of fig. 10. Two-thirds natural size.

Fig. 12.—A well-preserved specimen in matrix, showing typical ornamentation. Two-thirds natural size.

Fig. 13.—Transverse section of a small fragment showing the little difference in the length of the faces.

PLATE XXVI.

Conularia acutilirata, sp. nov.

Fig. 1.—Holotype showing rhombic cross section and wide apical angle.

Conularia inornata Dana.

Fig. 2.—A large almost complete specimen from the Upper Marine beds, Middle Permian. A little under half natural size.

Fig. 3.—Transverse section of fig. 2, slightly distorted. Natural size.

Conularia levigata Morris.

Fig. 4.—A typical specimen from the Lower Marine beds, Lower Permian. The transverse section is square. Two-thirds natural size.

Conularia inornata Dana.

Fig. 5.—A specimen showing typical ornamentation. Two-thirds natural size.

Fig. 6.—Transverse section showing strong rectangular nature of fig. 5.

Conularia tenuistriata McCoy.

Fig. 7.—An enlarged specimen showing 16-20 ridges within 10 mm. of shell. One and a quarter times natural size.

Fig. 8.—Transverse section of fig. 7, showing rhomboidal structure.

Conularia derwentensis Johnston.

Fig. 9.—An exceptionally well-preserved specimen from Mt. Wellington, Tasmania. Natural size.

Conularia tenuistriata McCoy.

Fig. 10.—A small specimen with numerous transverse ridges. Half natural size.

Fig. 11.—Transverse section of fig. 10. Natural size.

Conularia inornata Dana.

Fig. 12.—Almost complete specimen showing well-preserved ridges. Two-thirds natural size.

Fig. 13.—Transverse section of fig. 12. Half natural size.

Conularia tenuistriata McCoy.

Fig. 14.—Slightly enlarged specimen showing closely-set ridges, but with an almost square cross section.

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TWO QUEENSLAND SNAKES.

By

J. R. Kinghorn, C.M.Z.S.,
Zoologist, The Australian Museum.

(Figures 1–5.)

This brief paper contains a description and figures of a new species of *Glyphodon*, and a redescription of *Denisonia muelleri* Fischer, which is figured herein for the first time. There also is a reference to the disposition of the pre- and postfrontal bones in relation to the frontal and the orbital periphery in the above and allied genera.

Glyphodon Günther.

Glyphodon, Günther, Cat. Col. Snakes Brit. Mus., 1853, p. 210.
Boulenger, Cat. Snakes Brit. Mus., Vol. 111, 1896, p. 313.

A specimen belonging to this genus, collected by Mr. H. G. Barnard at Duaringa, Queensland, in company with Mr. J. R. Slevin, California Academy of Sciences, differs sufficiently from other well-known forms to warrant its being described as a new species. The head of a second specimen from Cooktown also agrees in detail with the Duaringa specimen. This head has been used to examine the cranial characters, but it is only necessary to mention here that the pre- and postfrontal bones meet in a broad suture, thereby excluding the frontal from the orbital periphery. Boulenger, in a footnote, makes reference to this character, but does not refer to the disposition of these bones in the closely allied genus *Pseudelaps*, now *Aspidomorphus*,[1] in which I find that they also meet, but only in a narrow suture. It might be mentioned that in some, if not all, species of *Demansia* the pre- and postfrontals form a broad suture, whilst in some species of *Denisonia* examined they do not meet, and the frontal enters the orbital periphery. This suggests that a most interesting and illuminating problem is to be solved by the examination of a complete series of skulls of Australian snakes.

The specimen before me shows that the maxillary does not extend quite as far forward as the palatine. The fang is followed by six teeth. The anterior mandibular teeth are enlarged, and much more so than in *Aspidomorphus*. The head is slightly distinct from the neck.

The eye is small with a vertically elliptic pupil. The nasal shield is slightly grooved but not divided.

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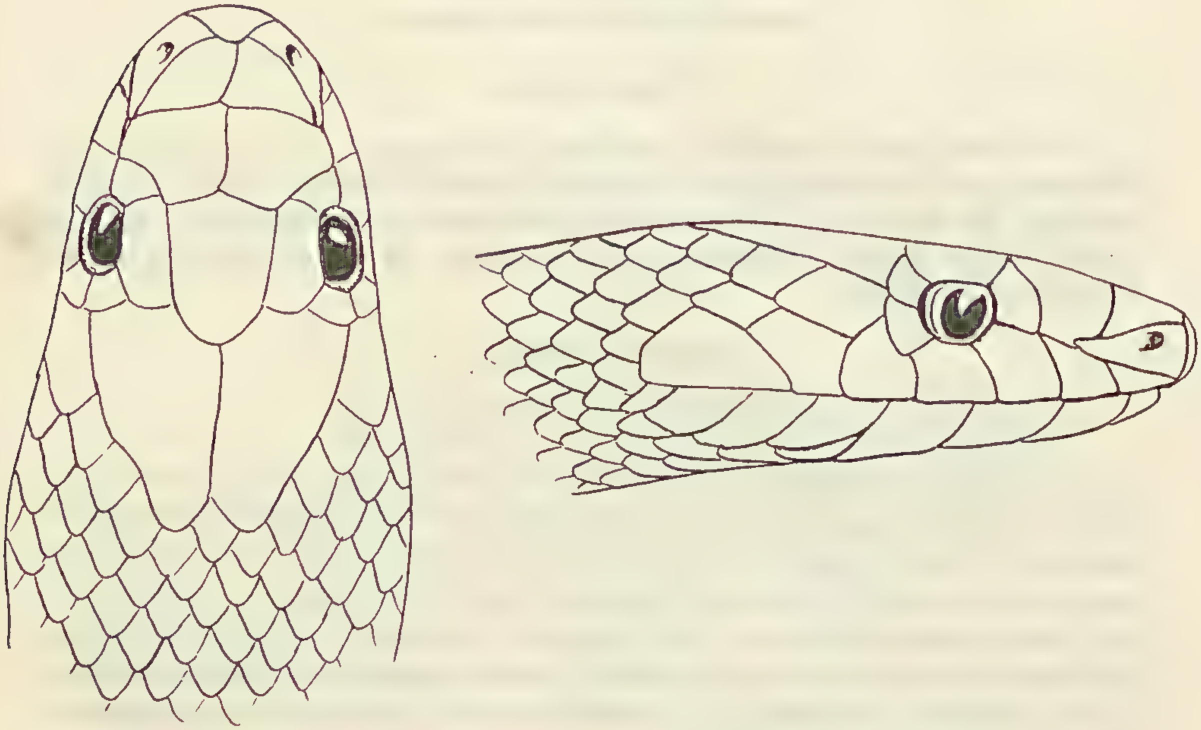
[1] It was recently pointed out by L. D. Brongersma in his Contributions to Indo-Australian Herpetology (Zool. Med. Mus. Leiden, xvii, 1934), p. 223, that the name *Pseudelaps* must give way to *Aspidomorphus*.

The differences between the specimen before me and its nearest relative are given below:

	Glyphodon tristis.	*Glyphodon.* sp. n.
Temporals	2 + 2	1 + 2
Scales on mid body	17	15
Ventrals	165 — 179	185
Subcaudals	38 — 52	40
Nasal shield	divided	single (slightly grooved)

Basing my contentions on the above, I have pleasure in naming this species after its finder, Mr. Barnard.



Figs. 1 and 2.—*Glyphodon barnardi,* sp. nov. From holotype. × 4½ approx.
J.R.K., *del.*

Glyphodon barnardi, sp. nov.

Description.—Head slightly distinct from neck. Eye small, but as deep as its distance from the mouth. Rostral about as deep as broad. Frontal shorter than the parietal, as long as its distance from the posterior border of the rostral, twice as broad as the supra-oculars. Parietals as long as their distance from the posterior border of the internasals. Prefrontals very large, wider than deep, and forming a broad suture with the second upper labial. Nasal slightly grooved, especially on its lower half, and sharply pointed posteriorly. It is widely separated from the preocular.

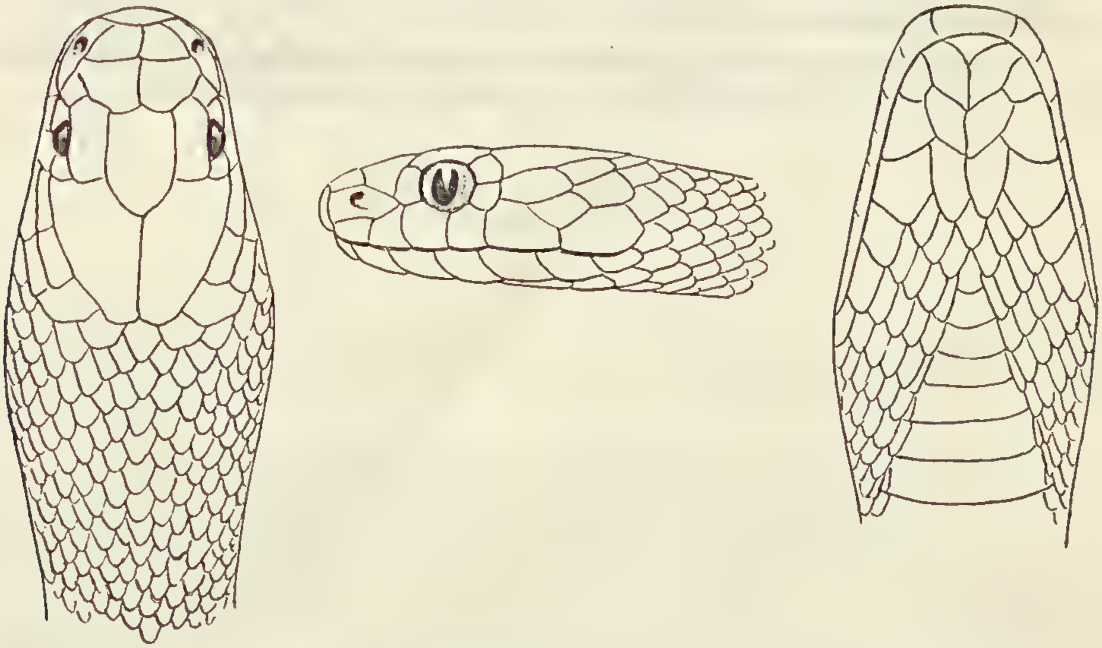
One single and two postoculars. Temporals 1 + 2. Upper labials 7. Lower labials 7, the third and fourth under the eye, and four in contact with the anterior chin shield. Ventrals 185. Anals 2. Subcaudals 40, paired.

Total length 480 mm., tail 60 mm.

Colour in spirits, uniform reddish brown above, the head and neck almost black with a yellowish patch on the nape. Underparts uniform yellowish.

Locality.—Fifteen miles south from Duaringa, Queensland, collected by Mr. H. G. Barnard. Holotype No. 77798, in the California Academy of Sciences, San Francisco, U.S.A.

The stomach of this specimen contained a comparatively large and undigested lizard of the genus *Egernia*.



Figs. 3-5.—*Denisonia muelleri*, Fischer. From a specimen in the California Academy of Sciences. × 4.

J.R.K., *del.*

Denisonia muelleri Fischer.

This little snake has eluded collectors for many years past, but was recently rediscovered by Mr. J. R. Slevin, who collected several specimens at Coomooboolaroo Station, 15 miles south of Duaringa, Queensland. It is here redescribed and figured for the first time.

Denisonia muelleri (Fischer) Boulenger, Cat. Snakes Brit. Mus., 111, 1896, p. 337. Kinghorn, Snakes of Australia, 1929, pp. 48 and 187.

Description.—Head quite as wide as body, and distinct from neck. Eye larger than its distance from the mouth, pupil vertically elliptic. Rostral a little broader than deep in front and visible from above. Frontal as long as the median parietal suture, slightly longer than its distance from the snout, broader than the supraoculars, and once and one-half times as long as broad. Prefrontals much longer than the internasals. Nostril in an undivided nasal which is in contact with the single preocular. Two postoculars. Temporals 2 + 2 + 1, the lower anterior wedged in between the fifth and sixth upper labial. Six upper labials, the third and fourth under the eye. Two pairs of chin shields, the posterior being the longest. The first pair of lower labials form a suture behind the mental. Body scales in 17 rows at the centre; 12–14 near the anal shield, and 18–19 on the neck. Ventrals 124. Subcaudals 30, single. Anal single. Total length 188 mm., body 161, tail 27 mm.

Colour (from a fresh spirit specimen), light olive brown above, each scale being slightly mottled or blotched. Head above and nape blackish with yellowish freckles. The snout is lighter, and a thread-like white line borders the black on the nape. There are two blackish lines on the neck, and from the rostral along the sides of the head the scales are finely speckled. The upper and lower labials are black at the edges and whitish in the centre. The chin and throat are heavily spotted and blotched, and the lateral scales the entire length of the body are dark blotched. The undersurface is mainly yellowish white.

Habitat.—Queensland.

The specimen figured and described is number R.12332 in the Australian Museum collection, a donation from the California Academy of Sciences.

A NEW SPECIES OF THREAD-WINGED LACEWING (FAMILY NEMOPTERIDAE, ORDER NEUROPTERA PLANIPENNA) FROM QUEENSLAND.

By

Keith C. McKeown,
Assistant Entomologist, The Australian Museum.

(Figure 1.)

The discovery of a new Australian species of Thread-winged Lacewing is of considerable scientific interest, especially one of such beauty and delicacy as that under review.

The family Nemopteridae contains some of the most remarkable insects to be found in the whole Order Neuroptera, and includes the Spoon-winged Lacewings (sub-family Nemopterinae) and the Thread-winged Lacewings (sub-family Crocinae). Four species have been previously recorded from Australia; two in the Nemopterinae, *Chasmoptera hutti* Westwood (1847) and *C. superba* Tillyard (1925), both from Western Australia, and two in the Crocinae, *Croce attenuata* Froggatt (1904) and *C. longipennis* Navás (1910), the former extending from Central Australia to Queensland, the latter occurring in Western Australia. The present species forms the third Australian member of the Crocinae.

Order NEUROPTERA.
Family NEMOPTERIDAE.
Sub-fam. CROCINAE.
Genus **Croce** MacLachlan, 1885.

Croce mira, sp. nov.

Head creamy above with four elongate brown markings on apex; *rostrum* creamy with a dark lateral stripe extending along genae and sides of rostrum from anterior margin of eye; *eyes* large, black, prominent, finely granulate; basal segments of *antennae* creamy-yellow, becoming clouded with brown, apical segments smoky-brown; *palpi* with segments banded with smoky-black.

Thorax creamy above with purplish-black markings; *prothorax* narrow, conical, lightly clothed with scattered stout black setae, sides gradually rounded, broadly margined with purplish-black laterally and with two small, elongate, longitudinal brown markings on anterior margin; *mesothorax* broad, laterally lobed, with a broad purplish-black lateral stripe and two narrow, parallel, longitudinal median stripes, broken at centre, of the same colour, base broadly emarginate; *metathorax* small, narrow, purplish-black with an inverted, raised cordate area of a yellow colour in its centre. *Legs* pale yellowish-white, thickly clothed with short, stout, black spines giving the limbs a dusky hue. *Tarsi* four-

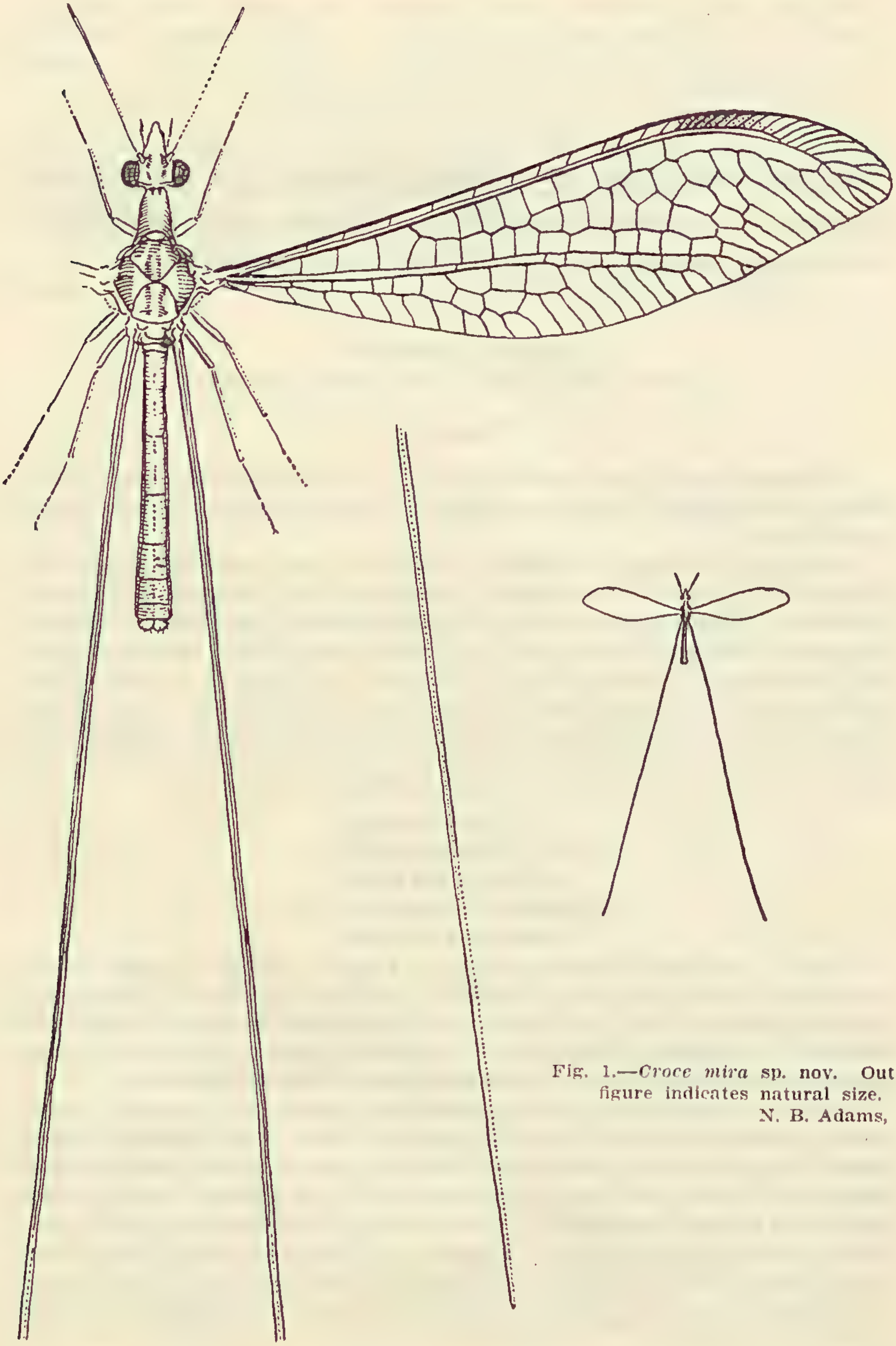


Fig. 1.—*Croce mira* sp. nov. Outline figure indicates natural size.
N. B. Adams, *del.*

jointed, segment 1 long, 2–3 short, 4 as long as 2–3 together, claws large, curved, black.

Wings.—Forewing hyaline except for a small patch of fuscous on pterostigma just before distal fusion of Sc and R_1. Veins setulose, black except for Sc and R_1, which are colourless, or with a slightly yellowish tint. Costal veinlets 24 in number. After fusing distally Sc and R_1 run obliquely downwards to below apex, leaving a rather wide pterostigmatic area above them. Rs has eight descending branches, Cu_1 five and Cu_1b two branches. Below Cu_2 + 1A is a single series of six veinlets. Apex narrowly rounded, slightly nodding. Forewing 3½ times longer than broad.

Hindwing excessively long (40 mm.) very slender and finely tapering. Basal portion for 12 mm. hyaline, with three distinct and stout veins, which I take to be Sc, R, and M, closely studded with short black setae; remainder white, setose.

Abdomen slender, cylindrical; colour creamy above, mottled and blotched with purplish-brown. Appendages very hairy, broadly forcipate, bright ferruginous. I believe the specimen to be a male.

Dimensions.—Total length of body 9 mm. Spread of wings 27 mm. Length of forewing 12½ mm. Breadth of forewing (at widest) 3½ mm. Length of hindwing 40 mm.

Female (?) similar, but abdomen rounded at extremity.

Hab.—Cunnamulla, Queensland (N. Geary), 10 November, 1938.

Holotype ♂ (?) and *allotype* ♀ (?) in Australian Museum, Sydney.

A very fine series of seven specimens of this beautiful insect was before me for examination.

STUDIES IN ICHTHYOLOGY.

No. 12.*

By

Gilbert P. Whitley,
Ichthyologist, The Australian Museum.

(Figures 1–3.)

Family ORECTOLOBIDAE.
Genus **Orectolobus** Bonaparte, 1834.
Orectolobus wardi, sp. nov.

Mr. Melbourne Ward has recently presented to the Australian Museum a further fine collection of fishes and elasmobranchs, the latest donation being from the Northern Territory, where he was attached to H.M.A.S. "Moresby" during her survey cruise of 1938. Amongst the sharks he caught was a wobbegong which agrees excellently with Regan's figure[1] of a north Australian specimen which Regan called *Orectolobus tentaculatus* (Peters). However, Peters' type came from South Australia and his name applies to the Wobbegong of Adelaide which has rows of tubercles on the back, more diffuse coloration, and is otherwise quite different. Thus the northern Australian species requires a new name, and I select Mr. Ward's specimen as type of the species, which I have much pleasure in naming after him. Austr. Mus. regd. no. IA.7784.

Loc.—Cape Keith, Melville Island, Northern Territory of Australia.

Family SQUALIDAE.
Subfamily ETMOPTERINAE Fowler, 1934.
Genus **Acanthidium** Lowe, 1839.

Acanthidium Lowe, Proc. Zool. Soc. Lond., vii, Oct., 1839, p. 91. Logotype, *A. pusillum* Lowe, from Madeira, selected by Goode & Bean, Oceanic Ichthyology, 1895, p. 10.

A genus of small, dark-coloured, deep sea dogsharks with five gill-slits and spined dorsal fins. Lowe's genus has been united with *Spinax* Cloquet, 1816 (= *Etmopterus* Rafinesque, 1810) by some authors, but is easily distinguished by having the first dorsal fin much smaller than the second and the ventrals just before the level of the second dorsal. In *Squalus spinax* Linné, the genotype of *Etmopterus*, these fins are entirely different, as Willughby's figure, the type of Linné's species, shows.

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* For No. 11, see Records of the Australian Museum, Vol. xx, No. 3, August, 1938, p. 195.

[1] Regan.—Proc. Zool. Soc. Lond., 1908, p. 357, pl. xii, fig. 2.

NATIONAL MUSEUM OF VICTORIA

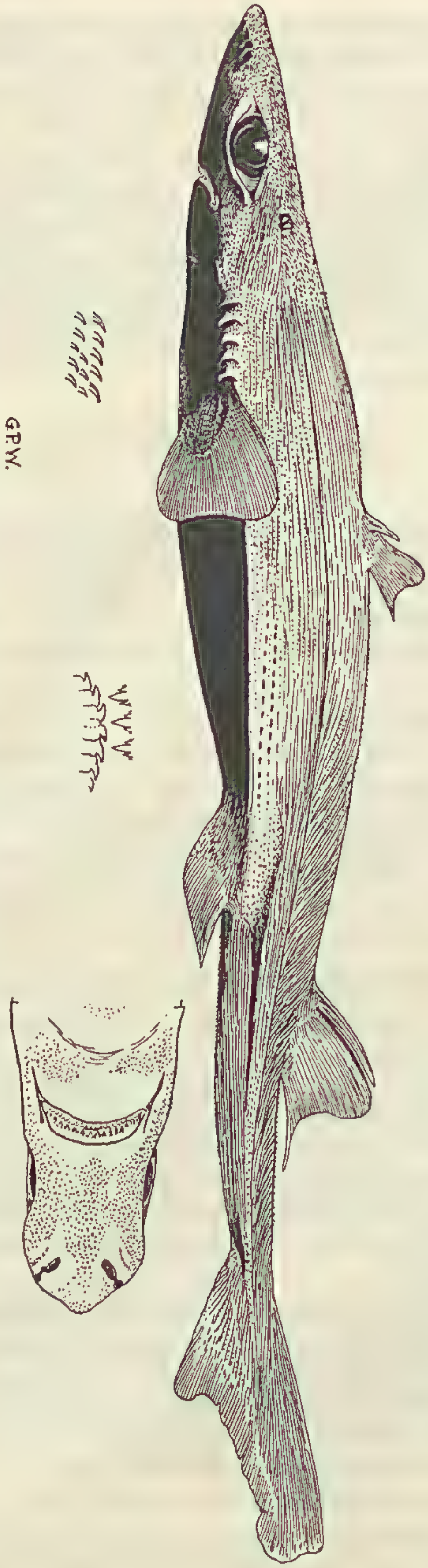

Fig. 1.—*Acanthidium molleri* Whitley. Holotype female, 360 mm. long, from east of Sydney, New South Wales; 130 fathoms. Austr. Mus. Regd. No. IA.5816. Below (left to right): dermal denticles, teeth, ventral surface of head.

G.P.W., *del.*

The genotype of *Acanthidium*, selected by Goode and Bean, was *A. pusillum*, but as that species was earlier named *Centrina nigra* by Lowe[2] its name becomes *Acanthidium nigrum* (Lowe). Garman[3] selected *A. calceus* as genotype, but Goode and Bean's selection is earlier and, fortunately, has been followed by most authors.

The various species of *Acanthidium* have been confused with those of *Etmopterus* or *Spinax* by authors, whilst some nominal species with a long, low first dorsal fin should be separated, like those of the genus *Deaniops*.

A new species of *Acanthidium* has recently come to light from deep water off New South Wales. Its closest allies appear to be *A. nigrum* (Lowe) from Madeira, and the following species of "*Etmopterus*": *A. hillianum* (Poey) from Cuba, *lucifer* (Jordan & Snyder) and *frontimaculatus* Pietschmann from Japan, and *brachyurus* (Smith) from the Philippines.

Acanthidium molleri, sp. nov.

(Fig. 1.)

A deep-sea shark with five gill-slits, no anal fin, each dorsal fin preceded by a prominent spine, and with glandular areas (probably luminous organs) on the lower parts of the body. General facies of the genotype of *Acanthidium* as figured in Lowe's *Fishes of Madeira*, Sept., 1843, p. 37, pl. vi, but distinguished by its much longer snout, more oblique nostrils, and various minor characters, as described below.

Head acute, somewhat flattened, about ¼ of the total length and nearly twice the depth of the body. Width of head across gills subequal to preoral length. A chain of pores on each side of fontanelle. Eye very large. Spiracles large. Nostrils large, oblique. Some crescentic creases across chin. Mouth transverse, not notably arched, and with long oblique lateral folds. Teeth of upper jaw in several series, pentacuspid, each tooth with a long central cusp and two small acute cusps on each side of it. Lower jaw teeth in a single row, unicuspid, their sides touching and their points deflected laterally.

Five small curved gill-openings, the last at the pectoral origin.

Body elongate, finely tapering posteriorly. The back is rounded but the ventral surface is somewhat flattened. Lateral line present. The ventral surface of head and body is covered with a blackish area, probably luminescent, which sends longitudinal branches of glandular skin along the sides between the ventral fins and the second dorsal and also on the lower parts of the caudal root. A series of black spots along the median line of the back and two or three more on the sides below the lateral line are discernible against the general dark brown ground-colour of the shark. The skin is densely invested with hook-like dermal denticles arranged in many longitudinal rows.

Dorsal fins preceded by prominent spines with shallow lateral grooves. Spine of first dorsal equidistant from nostril and second dorsal. Length of base of first dorsal fin (without the spine) about one-tenth dorsal interspace. Second dorsal fin much larger than first; both the fins thin and fragile. No anal fin. Pectorals small, their lower rays produced into a slight, blunt lobe. Ventral fins low, united around vent; their origins are nearer the pectorals than the caudal. Caudal fin shorter than head, with a notch below its terminal part.

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[2] Lowe.—Proc. Zool. Soc. Lond., 1833 (April, 1834), p. 144. Madeira.

[3] Garman.—Bull. Mus. Comp. Zool. Harvard, xlvi, 1906, p. 202.

Described and figured from the holotype of the new species, the larger of two females (360 mm. or 14¼ inches) from the same locality.

Austr. Mus. Regd. Nos. IA.5816 (holotype) and 5817 (paratype).

Loc.—About thirty miles eastward of Sydney, New South Wales; trawled in 130 fathoms depth in June, 1933, by Captain K. Moller, in whose honour the species is named. The trawlers very rarely fish in this great depth, and on that occasion three other species of fishes were secured: *Undecimus hendecacanthus* (McCulloch), *Centriscops obliquus* Waite, and *Owstonia maccullochi* Whitley; these were new records for this State and were recorded in the supplement to the third edition of McCulloch's Fishes of New South Wales in 1934. The sharks, however, were set aside until now for determination.

Family CALLORYNCHIDAE.

Genus **Callorynchus** Meuschen, 1781.

Callorynchus milii Bory.

? *Squalus rhinophanes* Péron, Voy. Terres Austr., i, 1807, p. 337. Virtual nude name. Adventure Bay, Tasmania.

Callorynchus milii Bory de St. Vincent, Dict. Class. Hist. Nat., iii, Dec., 1823, p. 62, pl. cxiii, fig. 1. Western Australia [? error for Tasmania—G.P.W.].

Callorhynchus tasmanius Richardson, Proc. Zool. Soc. Lond., viii, Aug., 1840, p. 29. Murderer's Bay, "Tasmania" [should be New Zealand], Jan. 16, 1770 (Solander); also Port Arthur, Tasmania.

Callorhynchus australis Owen, Descr. Cat. Comp. Anat. Mus. Roy. Coll. Surgeons, ed. 2, i, 1852, p. 51. Type-loc. hereby designated Tasmania. Not *Chimaera australis* Shaw, 1804, another species of *Callorynchus*.

? *Callorhynchus peronii* Duméril, Hist. Nat. Poiss., i, 2, 1865, p. 694. Terres australes (Péron) and South America.

Callorhynchus dasycaudatus Colenso, Trans. N. Zeal. Inst., xi, May, 1879, p. 298, pl. xvii. Poverty Bay, New Zealand.

The Elephant Shark of Australia and New Zealand has received several names, as the above synonymy shows. The species may now be added to the New South Wales list as four specimens were noticed by Mrs. Tom Iredale in a Manly fish-shop and were purchased for the Australian Museum. All were males and are registered Nos. IA.7508–7511. The exact locality was not known, but they were freshly caught, in March, 1938, probably not very far away from Sydney. I have seen old paintings of this species, purporting to be from New South Wales, in the Watling and Raper drawings, made in the 18th century and now in the British Museum and the Mitchell Library, Sydney, but hesitated to record the species from New South Wales without actual specimens. Apparently it is either a very occasional visitor or else was here in the days of the early settlers and has since become practically extinct in this State. It is common at times in Tasmania and New Zealand, and is also known from Victoria and South Australia, but Mr. Ludwig Glauert, of the Museum at Perth, tells me he has not seen any Western Australian specimens. Bashford Dean has figured two kinds of *Callorynchus* eggs from Australia, but I am uncertain as to whether we have more than one species of Elephant Shark in our waters.

Family GALAXIIDAE.

Genus **Galaxias** Cuvier, 1816.

Galaxias ornatus Castelnau.

Galaxias ornatus Castelnau, Proc. Zool. Acclim. Soc. Vict., ii, May 10, 1873, p. 153. Cardinia Creek, Victoria.

Galaxias pusillus Mack, Mem. Nat. Mus. Melb., ix, Nov. 1936, p. 101, fig. 2. Cardinia Creek, Victoria.

Mack's species is evidently the young stage of Castelnau's, from the same locality; the few discrepancies in their descriptions may be accounted for by changes during growth.

Galaxias bongbong Macleay.

Galaxias bongbong Macleay, Proc. Linn. Soc. N. S. Wales, vi, 2, Sept. 12, 1881, p. 233. Moss Vale and Bong Bong, New South Wales.

Three fine specimens (Regd. Nos. IA.7904–7906) from a creek near Bombala, New South Wales, are the first of their species in the Australian Museum. The types are in the Macleay Museum, University of Sydney.

Family MYCTOPHIDAE.

Mystibranchus, gen. nov.

Phanerobranchus Cocco, Giorn. Gab. Messina (5) viii, 1846, p. 63. Orthotype, *P. krohnii* Cocco.

Id. Jordan, Gen. Fish, iv, 1920, p. 574, and Classif. Fish., 1923, p. 155.

Preoccupied by *Phanerobranchus* Leuckart, Isis, 1821, Litt. Anz., p. 260, a genus of Amphibia.

This curious fish requires a new generic name, Cocco's being preoccupied. The type-species now becomes *Mystibranchus krohnii* (Cocco).

Family SYNGNATHIDAE.

Genus **Phycodurus** Gill, 1895.

Phycodurus glauerti, sp. nov.

Similar in general characters to the type of the genus, *P. eques* Gunther,[4] from Port Lincoln, South Australia, but readily distinguished by its longer snout, the length of which is five times that of the eye-diameter, and does not bear leaf-like processes; the nuchal spines arise farther back on the head and their crests are joined to them, not partly separated like a cockscomb. The long dorsal spines bear broad, swollen, serrated crests, similar to those in Waite and Hale's figure.[5] There is no pair of spines between the largest pair on the back and the origin of the dorsal fin, and the small mediolateral spines cease below the dorsal.

D.36, its base comparatively longer than in the genotype. Rings 19 + 43.

Colour reddish-brown generally, with the leafy processes and the dorsal base blackish-brown. A few dark brown marks radiating from eye. No white transverse bands.

Loc.—Rottnest Island, Western Australia.

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[4] Gunther.—Proc. Zool. Soc. Lond., 1865, p. 327, pl. xv.

[5] Waite and Hale.—Rec. S. Austr. Mus., i, 1921, p. 315, fig. 52.

Described from the holotype, a dried specimen less than ten inches in total length. Austr. Mus. Regd. No. IA.7596.

Named in honour of Mr. Ludwig Glauert, the well-known Western Australian naturalist.

Family BELONIDAE.

Genus **Stenocaulus** Ogilby, 1908.

Stenocaulus perornatus Whitley.

(Fig. 2.)

Stenocaulus perornatus Whitley, Rec. Austr. Mus., xx, 1938, p. 233. Upper Sepik R., New Guinea.

D.ii, 15; A.ii, 18; P.i, 10; V.i., 5; C.13. L. lat. *circa* 144.

Head (206 mm.) 2·4, depth (55) 8·4 in standard length (495). Distance from eye to tip of snout (135 mm.) 1·5, Eye (18) 11·4, Interorbital (16) 12·8, and pectoral (40) 5·1 in head.

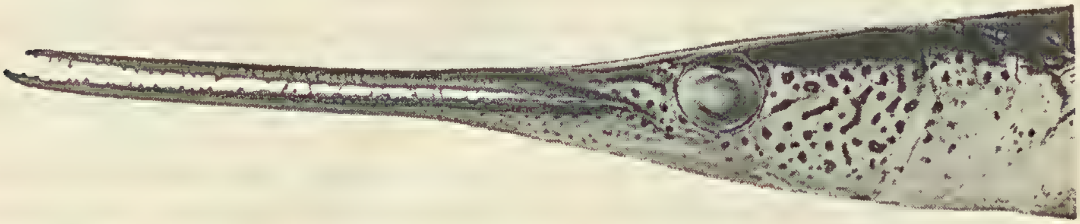

Fig. 2.—*Stenocaulus perornatus* Whitley. Holotype, 495 mm. in standard length, from the Upper Sepik River, New Guinea. Austr. Mus. Regd. No. IA.7287.
G. C. Clutton, *photo.*

Opercula scaly. Jaws long and beak-like. Canines erect and with smaller upright teeth around about them. Lower jaw the longer, with a produced tip.

No gill-rakers. Form elongate, compressed, the height of the body being about twice its breadth. Head and body very scaly, about 118 predorsal scales.

Lateral line running low, dipping down over posterior anal rays, not keel like; branches extend to the pectorals.

Caudal peduncle elliptical in cross-section, not depressed or keeled. Dorsal and anal short, with blunt lobes. Origin of dorsal slightly behind that of anal, over second divided anal ray.

Ventrals small, origin midway between preopercular margin and root of tail. Pectorals pointed. Caudal fin emarginate, lobes bluntly rounded.

In formalin, colour yellowish. The head with conspicuous large dark brown spots, sometimes coalescing. Upper parts of body dark brown, as is also a diffuse median stripe. Sides of body with small dark brown spots, more or less arranged in longitudinal rows. Fins dusky, especially caudal margin. Pectoral axil dark. Eye bluish. A blue spot at upper angle of preoperculum.

Described and figured from the holotype, a specimen 495 mm. in standard length or about 21½ inches overall. Austr. Mus. Regd. No. IA.7287.

Loc.—Upper Sepik River, New Guinea; collected by Flight-Lieutenant Stuart Campbell.

Family MELANOTAENIIDAE.

Genus **Rhombosoma** Regan, 1914.

Rhombosoma affinis (Weber).

Rhombatractus affinis Weber, Nova Guinea, v, 2, 1909, p. 234, pl. xi, fig. 5. Sentani Lake and Wagani R., New Guinea.

This species is a northern one, distinct from *novae guineae* or *goldiei.*

Seven specimens (IA.7296–7301 and 7321) 42 mm. to 87 mm. in standard length, from the Bulolo Goldfields, New Guinea (Dr. Carl Günther). Collector's Nos. 10 and 91.

Rhombosoma sepikensis Herre (Field Mus. Nat. Hist. Zool. Ser., xviii, 12, 1935, p. 400 *et ibid.*, 1936, p. 445, fig. 47) appears to be a synonym of *affinis.*

Family STROMATEIDAE.

Genus **Cubiceps** Lowe, 1843.

Cubiceps baxteri McCulloch.

Cubiceps baxteri McCulloch, Rec. Austr. Mus., xiv, Feb. 28, 1923, p. 15, pl. i, fig. 4. Lord Howe Island. Holotype in Australian Museum.

A fine large specimen, 420 mm. in standard length, from Shellharbour, New South Wales, July, 1938 (Mr. Latta), constitutes a new record for Australia. Austr. Mus. Regd. No. IA.7585. It was found stranded on the ocean beach, alive, on July 11th, 1938.

Only two other specimens of this rare fish are known, both smaller and both from Lord Howe Island, collected by R. E. Baxter (Austr. Mus. Nos. IA.686, holotype, and IA.1393).

Several species of fishes, crustaceans, and molluscs, known from Lord Howe Island are found again on the Australian coastline at Shellharbour or in South Queensland, but not in between. Possibly these are borne on currents with pelagic organisms.

Family APOGONIDAE.

Genus **Glossamia** Gill, 1863.

Glossamia gillii (Steindachner).

Apogonichthys gillii Steindachner, Sitzb. Akad. Wiss. Wien, lv, 1867, p. 11, pl. i, fig. 1. Fitzroy River, Rockhampton, Queensland.

Apogonichthys adspersus Castelnau, Proc. Linn. Soc. N. S. Wales, ii, 3, May, 1878, p. 226. Rockhampton, Queensland.

Apogonichthys roseobrunneus Macleay, Proc. Linn. Soc. N. S. Wales, v, 3, 1881, p. 348. "From River in Northern Queensland."

The holotype of *Apogonichthys roseobrunneus* Macleay, labelled "Northern River" in the Macleay Museum, University of Sydney, is actually *Glossamia gillii.* Probably *Apogonichthys adspersus* Castelnau, from Rockhampton, is another synonym.

Family CORYPHAENIDAE.

Genus **Coryphaena** Linné, 1758.

Coryphaena Linné, Syst. Nat., ed. 10, Jan. 1, 1758, p. 261. Logotype, *C. hippurus* Linné, selected by Jordan and Gilbert, Bull. U.S. Nat. Mus., iii, 16, 1882, p. 454. Variants: *Coriphaena, Coryphaea, Coryphena,* etc., of authors.

Caranxomorus Lacépède, Hist. Nat. Poiss., iii, 1802, p. 82. Logotype, *C. pelagius* Lacépède = *Scomber pelagicus* Linné, selected by Jordan and Evermann, Bull. U.S. Nat. Mus., xlvii, 1896, p. 952.

Lepimphis Rafinesque, Caratt, n. gen., 1810, p. 33. Logotype, *L. hippuroides* Rafinesque, according to Jordan, Gen. Fish., 1917, p. 79.

Lampugus Cuvier and Valenciennes, Hist. Nat. Poiss., ix, 1833, p. 317. Logotype, *Lampugus pelagicus* Cuv. & Val. = *Scomber pelagicus* Linné, selected by Jordan and Evermann, Bull. U.S. Nat. Mus., xlvii, 1896, p. 952.

Fares Alph. G., Dict. pittoresque H.N., iii, livr. 181, 1835, p. 164. Haplotype, *F. caerulescens* G. from the Red Sea. Equivalent to "Caranxomore" Lacép.
Id. Alph. G., Nouv. Dict. class H.N., ed. 2, xii, July, 1845, p. 345.

Carangomorus Agassiz, Nomencl. Zool., 1846, Index. Univ., p. 65. Emendation for *Caranxomorus* Lacépède. Type, by present designation, *Caranxomorus pelagicus* Lacépède.

Lepimphius Agassiz, Nomencl. Zool., 1846, Index Univ. p. 205. Error for *Lepimphis* Rafinesque 1815. Type, by present designation, *Lepimphis hippuroides* Rafinesque.

Sarda Gronow, Cat. Fish. coll. Gronow. Brit. Mus. (ed. Gray), 1854, p. 119. Logotype, *S. immaculata* Gron., selected by Jordan, Gen. Fish., ii, 1919, p. 259. Preoccupied by *Sarda* Cuv. 1829, another genus of fishes.

Ectenias Jordan and Thompson, Mem. Carneg. Mus., vi, 4, Sept., 1914, p. 241. Orthotype, *E. brunneus* J. & T., *loc. cit.*, pl. xxvii, fig. 3, from Misaki, Japan.

Coryphaena hippurus Linné, subsp. **dampieri**, nov.

"Dolphin" Dampier, Voy. New Holland, i, 1701, pl. ii, fig. 7. Western Australia.

Coryphaena hippurus Linné, Syst. Nat., ed. 10, 1758, p. 446. *Ex* Osbeck, and Artedi. "Hab. in Pelago" = The Grass Sea, 24° 15′ N. lat., according to Osbeck, Voy. Chin. E. Indies (trans. Forster), ii, 1771, p. 117.

Coryphaena punctatula Ramsay, Ann. Rept. Austr. Mus., 1876 (1877), p. 6. Botany Bay. Error for *Coryphaena punctulata* Günther.

Coryphaena punctulata Macleay, Proc. Linn. Soc. N. S. Wales, v, May 20, 1881, p. 552; Cat. Austr. Fish., i, 1881, p. 187.
Not *Lampugus punctulatus* Cuv. & Val., Hist. Nat. Poiss., ix, 1833, p. 327, from America.

Coryphaena hippurus Ogilby, Cat. Fish. N. S. Wales, 1886, p. 28. Botany Bay; 22 inches.
Id. Waite, Mem. N.S.W. Nat. Club., i, 1904, p. 43.
Id. Stead, Fish. Austr., 1906, pp. 173 and 264, pl. v; Ed. Fish N. S. Wales, 1908, p. 101. Sydney Markets; rare.
Id. McCulloch, Austr. Zool., ii, 2, 1921, p. 54.
Id., McCulloch, Austr. Mus. Mem., v, 1929, p. 194.
Id. Hale, 47th Ann. Rept. Mus. S. Austr., 1931, p. 10. Port Wakefield—new record for South Australia.
Id. Powell, Rec. Auck. Inst. Mus., ii, 3, 1938, p. 155. Cape Brett—new record for New Zealand.

The above are references to literature on Australian *Coryphaena*: no attempt has been made to quote the enormous literature on extralimital specimens.

A convenient-sized specimen is described hereunder:

D. *circa* 59. A. 23. P. 22. V.i/5. C. 16.

Dimensions in millimetres: head, 140; eye, 24; interorbital, 51; snout, 50; upper jaw, 66; postorbital, 68; pectoral, 102; ventral fins, 120 and 125; depth of caudal peduncle, 35.

The standard length is approximately 700 mm. and total length 870, or about 720 to end of middle caudal rays.

General habit as in Stead's plate v (*loc. cit.*).

Form elongate, compressed tapering.

Upper profile of head rising as an even arc to dorsal fin. Eye low.

Nostrils one-third distance between eye and snout.

Mouth extending to below anterior half of eye. Lower jaw longer. Small spaced upright teeth form an outer row on jaws, and there are some smaller ones forming broad toothed areas anteriorly. Other teeth on roof of mouth.

Body covered with subelliptical cycloid scales, irregularly imbricate in the rather tough integument. Each scale with several pronounced concentric ridges. Scales become lanceolate along the back and near anal base, but do not extend over the fins, except on the caudal, the lobes of which they invest. Some scales on cheeks and operculum. Rest of head naked. Lateral line forming an angular peak over pectoral, then running straight along middle of sides to middle caudal rays. The vent is a little in advance of the anal fin.

Dorsal elevated anteriorly, its lobe equal to head minus snout. The anterior rays very close together, middle ones approximate, and the last seven or eight widespaced. It originates at level of eye and terminates opposite end of anal. Anal originates in anterior half of fish and has an anterior lobe.

Pectoral short, falciform. Ventrals pointed, fitting into a groove along belly, and each united to the midline by membrane. Caudal very deeply forked. Colour in life probably variable. Colour in alcohol, dark bluish to greyish. A few small scattered dark grey spots on lower parts of sides. Some yellow on belly and on ventral bases and edge of anal. Caudal yellowish with smoky edges.

Described from a specimen, type of new subspecies *dampieri*, about 700 mm. in standard length or 34½ inches overall.

Austr. Mus. Regd. No. IA.7561.

Loc., Lord Howe Island, 1937. Coll. E. le G. Troughton.

New record for Lord Howe Island.

This is the *Coryphaena hippurus* of Australian authors, not strictly that of Linné, whose type came from the Sargasso Sea. His species has an extensive extralimital synonymy, but no local name concerns the Australian form, which has been recorded from South Australia and New South Wales.

The Dolphin is probably common in schools off our coasts, but is rarely caught nowadays so that there are few Australian records. I have seen several old paintings of dolphins made by travellers to Australia in the early days of sailing ships, but their specimens probably came from the Atlantic Ocean.

The Rev. J. Done wrote in a letter of 1926 from Mabuiag Island, Torres Strait, that the colours of a four-foot specimen were:

> "Emerald green eyes, black pupils. Dark bluish in colour on back and top sides, white elsewhere with a little yellow on belly near swimming [ventral] fins and small dark blue spots on the white parts."

Another Queensland specimen (Qld. Mus. No. I.4502) was mentioned by Mr. H. A. Longmann *in lit.*, April, 1930. It came from Mooloolabah, South Queensland; total length 37 inches, presented by Mr. George Hissted. Thus the species can now be listed from Queensland, too.

A 5 lb. specimen was caught 9 miles off Manly, New South Wales, in March, 1927, and I have seen the species landed at Maroubra Beach, near Sydney.

Hale has recorded *Coryphaena* from South Australia, and Dampier's old figure is recognizable as a Western Australian example. The range is thus practically circum-Australian and Lord Howe Island, probably linking up with forms from Oceania.

Family LOBOTIDAE.

Genus **Datnioides** Bleeker, 1853.

Datnioides campbelli, sp. nov.

Br. 6. D.xi.1, 13; A.iii, 10; P.i.18; V.i.5; C.15.
L. lat. 42 to hypural joint. L. tr. 6/1/20.

Agrees in general characters with *Datnioides quadrifasciatus* (Sevastianov), as described by Weber and de Beaufort (Fish. Indo-Austr. Archip., vii, 1936, p. 462, fig. 92) but differs in having less oblique profile, rounded caudal fin, and larger scales, etc. Teeth all villiform in jaws; none on palate.

Intermaxillary pedicels long but not reaching half-way over eye. Eleven club-like gillrakers on lower half of first branchial arch.

Body deep, compressed, covered with large adherent scales which extend on to the fins (except the ventrals).

Dorsal and anal spines very strong and heteracanth; the soft fins rounded. Fourth dorsal and second anal spine the longest in their respective fins, but shorter than the longest rays. Caudal rounded, not excavate. Ventral fins not nearly reaching vent. In formalin, colour dark brownish forming diffuse irregular bands, four or five in number, across the light brownish body.

Fins dark brown, almost black, except pectorals, which are pale yellowish.

Described from the holotype, a specimen about 320 mm. in standard length or 16 inches overall. Austr. Mus. Regd. No. IA.7288.

Loc.—Upper Sepik River, New Guinea. Collected by Flight-Lieutenant Stuart Campbell, in honour of whom this fine perch-like fish is named. In association with it were presented specimens of *Arius*, *Lambertichthys*, *Oxyeleotris*, *Toxotes*, *Acanthoperca*, and *Stenocaulus*.

Family PEMPHERIDAE.

Genus **Liopempheris** Ogilby, 1913.

Liopempheris affinis McCulloch.

Liopempheris affinis McCulloch, Zool. Res. Endeavour i, Dec. 22, 1911, p. 45, pl. vii, fig. 1. Port Jackson, N. S. Wales. Type (No. B7332) in Austr. Mus., Sydney.

A small damaged specimen of this species was found by Mr. Melbourne Ward on Caloundra beach.

New record for Queensland.

Family SARDIDAE.

Genus **Neothunnus** Kishinouye, 1923.

Neothunnus macropterus (Temminck and Schlegel).

Thynnus macropterus Temminck & Schlegel, Fauna Japonica, Pisces 1844, p. 98, pl. li. South-western Japan.

Neothunnus macropterus Whitley, Rec. Austr. Mus., xx, 1937, p. 13 (references).
Id. Stead, Austr. Nat. x, 4, 1938, p. 124.

Quite recently, this species has been caught in northern New South Wales, Queensland, and at Lord Howe Island. The first specimen recorded from Australia was caught off Bermagui, New South Wales, in 1936, so that its range is now extended, and it is evident that the species is common at times off the eastern Australian coastline.

The following is a list of species of fishes which have been added to the New South Wales list in the last few years, with a few new records:

Callorynchus millii Bory. The Elephant Shark.
Alopias greyi Whitley. Green Thresher Shark.
Acanthidium molleri, sp. nov. Moller's Dogshark.
Scalanago lateralis Whitley. Eel.
Stromateus maculatus Forster.
Narooma benefica Whitley. Deep-sea fish.
Stomias affinis Gunther. Deep-sea fish.
Argyropelecus amabilis (Ogilby). Hatchet Fish. IA.8024. C.S.I.R. Station 104/38. N.200, N. S. Wales.
Collettia perspicillata (Ogilby). Lantern Fish. IA.8023. C.S.I.R. Station 104/38. N.200, N. S. Wales.
Saccopharynx schmidti Bertin. Gulper.
Cubiceps baxteri McCulloch.
Taractes miltonis Whitley. Allied to Ray's Bream.
Pteraclis velifer australiae Whitley. Wing Fish.
Cybiosarda elegans Whitley. Watson's Mackerel.
Neothunnus macropterus (Temminck & Schlegel). Yellow-fin Tuna.
Scarus pyrrhostethus (Richardson). Parrot Fish.
Enigmapercis reducta Whitley.
Centropogon marmoratus Gunther.
Ellogobius abascantus Whitley. Goby.
Stephanolepis melanocephalus (Bleeker). Mr. Melbourne Ward has collected this Leatherjacket at Nambucca Heads, Sept., 1937.
Strophiurichthys inermis Fraser-Brunner. Boxfish.
Crenalticus meleagris (Cuv. & Val.).

I have also several more species to record at a later date, including a Melanotaeniid, several different gobies, and some juvenile Surgeon fishes. The Whale Shark (*Rhincodon typus* Smith) has also been reported from New South Wales.

Family CORIDAE.

"Platyglossus margaritaceus Macleay."

(Fig. 3.)

Platyglossus margaritaceus Macleay, Proc. Linn. Soc. N. S. Wales, viii, July 17, 1883, p. 274. Hood Bay, New Guinea. Holotype in Macleay Museum, University of Sydney. Not *Julis margaritaceus* Cuvier and Valenciennes, Hist. Nat. Poiss., xiii, 1839, p. 484, from Vanikoro, Santa Cruz Islands.

Halichoeres macleayi Jordan and Seale, Bull. U.S. Bur. Fisheries, xxv, 1905 (Dec. 15, 1906), p. 303. New name for *Platyglossus margaritaceus* Macleay, *non* Cuv. & Val. Hood Bay, New Guinea. *Id.* Fowler, Mem. Bern. P. Bishop Mus., x, 1928, p. 342.

Mr. K. E. W. Salter, B.Sc., Curator of the Macleay Museum, University of Sydney, allowed me to examine the unique holotype of this species in the late Sir William Macleay's collection, where it is labelled "*Platyglossus margaritaceus*, Cuv. & Val., Port Moresby. F.537. No. 940".

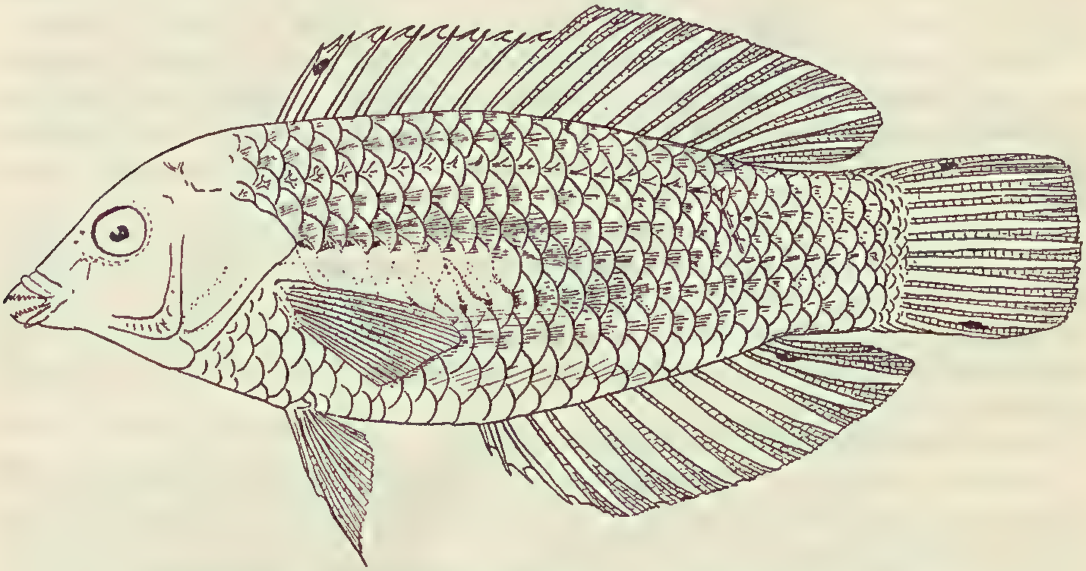

Fig. 3.—*Platyglossus margaritaceus* Macleay. Holotype, 95 mm. long, from Hood Bay, Papua. Macleay Mus. Regd. No. F.537, No. 940, University of Sydney.
G.P.W., *del.*

Though it is labelled "Port Moresby", I have no doubt that this specimen is Macleay's type, which was described from Hood Bay, not very far away from Port Moresby. There is no other specimen like it in either the Macleay Museum or the Australian Museum. It is 95 mm. in total length.

Macleay's description is brief, and is the only published information available about this species:

"D.7/11; A.2/11. L.lat. 25.

"Of compressed form. The height of the body rather more than one-fourth of the total length; snout pointed, teeth prominent. Eyes small; tail truncate. Colour (in spirits) yellowish, darker on the top of the head, with a broad pearly stripe more or less edged with black, extending from the operculum to, or nearly to, the tail, there seems to have been also a large oval pearly spot on the operculum. The fins are yellow, with a small black spot on the first dorsal spine, the last anal ray, and on the middle of the uppermost and lowest caudal rays. Hood Bay."

A more detailed description is now offered, as follows:

D.vii/11; A.iii/11; P.12; V.i/5; C.12 et lat. brev. Sc. 25. L.lat. 20 + 2 + 6. L.tr. 2/1/7 on body to 3/1/3 on caudal peduncle.

Head (26 mm.) 2·8 in standard length (73) and subequal to depth of body (27). Eye (5) 5·2, interorbital (6) 4·3, snout (6·5) 4 in head. Depth of caudal peduncle (14) subequal to longest dorsal ray (14·5).

General habit as shown in the figure. Head compressed, pointed, naked. A few mucus tubes around eyes and on preopercular flange, others on nape. Nostrils inconspicuous, before eye. Seven curved acute teeth on either side of each jaw and antrorse canines posteriorly in upper jaw. The anterior teeth are canine-like but are not flared forwards.

Body deep, compressed, covered with large imbricate cycloid scales which are strongly reticulated. Those on the breast are not enlarged. Ventral axillary scale small. Predorsal scales are now missing; there may have been a few originally. No scaly sheaths to dorsal and anal fins. Lateral line consisting of scales with branched tubes, the line following the curve of the back to below the posterior dorsal rays where it bends steeply to continue along middle of caudal peduncle.

Seven pungent dorsal spines; the first two parallel and not notably separated from the others. Spinous dorsal membranes flagged. Dorsal and anal fins expansive, the anal originating below the last dorsal spine and terminating behind the end of the dorsal base level. Pectorals small. First ventral ray long. Caudal truncate.

The colours have faded but the patterns mentioned by Macleay can still be traced after about sixty years' preservation in alcohol, and the pearly area on the sides is very well marked. There is also a pearly patch on the gill-cover.

Described and figured from the holotype of the species, a specimen 95 mm. (3¾ ins.) in total length. Macleay Museum, Regd. No. F.537, No. 940. University of Sydney.

Loc.—"Port Moresby" = Hood Bay, Papua.

Dr. L. F. de Beaufort has suggested (*in lit.*) that *Platyglossus margaritaceus* Macleay may represent a new genus. As he proposes to deal with its generic status in a paper concerning an allied Philippine fish, I make no nomenclatural changes at this stage. This species, like most of Macleay's, seems to be quite valid, and does not agree with any in numerous works I have consulted.

It bears some superficial resemblance to *Julis vanikorensis* Quoy and Gaimard (Voy. Astrolabe, Zool. iii, 1835, p. 704, pl. xx, fig. 1, from the Santa Cruz Islands), which was said to have two *rays* before the seven dorsal spines, but the Vanikoro fish differs in form and coloration and is evidently not conspecific with Macleay's; indeed, Fowler lists *Julis vanikorensis* as a synonym of *Novaculichthys taeniourus* (Lacépède).

Family RHYACICHTHYIDAE.

Genus **Rhyacichthys** Boulenger, 1901.

Rhyacichthys aspro (Cuv. and Val.).

Platyptera aspro Cuvier & Valenciennes, Hist. Nat. Poiss., xii, March, 1837, p. 321, pl. ccclx. Bantam. *Ex* Kuhl & Van Hasselt, MS.

One specimen of this curious torrent-loving fish has been sent by Rev. J. B. Poncelet, S.M., from Morou, twelve miles inland from Buin, Bougainville Island, Solomons; 14th July, 1937. Native name: Lumiago. Austr. Mus. Regd. No. IA.7307. The species has not hitherto been recorded from this part of Oceania and was not represented in the Australian Museum collections.

Family ELEOTRIDAE.

Genus **Mogurnda** Gill, 1863.

Mogurnda aurifodinae Whitley.

Mogurnda aurifodinae Whitley, Rec. Austr. Mus., xx, 1938, p. 233. Bulolo goldfields, New Guinea.

A species from northern New Guinea which is separable from its congeners by its fin-formulae and coloration, the top of the head having a few well-marked dark spots.

D.viii/15 (last divided); A.14; P.15 (dex.) or 14 (sin.); V.i/5; C.13 et lat. brev. About 40 scales between axil and hypural joint. L.tr. 14. About 16 predorsal scales and 12 between dorsal and anal rays. Nine short spaced gillrakers on lower limb of first branchial arch.

Head (27 mm.) 3·3, depth (17·5) 5·1 in standard length (90). Eye (5) 5·4, interorbital (10·5) 2·5, snout (5) 5·4, depth of caudal peduncle (11·5) 2·3, pectoral (18) equal to longest dorsal ray (18) and 1·5 in head.

General characters as defined for the genus by McCulloch and Ogilby (Rec. Austr. Mus., xii, 1919, p. 279), and the typical species *mogurnda*, but the mucous system is inconspicuous, and the number of fin-rays is higher than that of any of a long series of Australian specimens.

General colour, in alcohol, light brownish with seven or eight very diffuse and inconspicuous darker areas across the body, the most posterior of which forms a precaudal blotch. Some of the scales on the top of the head have a central brown spot. Two oblique dark brown bars reach backwards and downwards from the bluish eye to the operculum. A dark brown blotch on upper half of pectoral base. Belly yellowish. Membranes of dorsal fins infuscated, as are also, to a less extent, those of the other fins, the pectorals being lightest.

Described from the holotype of the species, a specimen 90 mm. in standard length or 4⅝ inches overall. Australian Museum Regd. No. IA.7322. Collector's No. 92. A paratype is IA.7323; coll. No. 93.

Loc.—Bulolo Goldfields, New Guinea; Dr. Carl Günther.

Family SCORPAENIDAE.

Genus **Centropogon** Günther, 1860.

Centropogon marmoratus Günther.

Centropogon marmoratus Günther, Ann. Mag. Nat. Hist., xi, Feb. 1, 1863, p. 136. Moreton Bay, Queensland.

This Queensland species extends into New South Wales, although McCulloch did not include it in his Check-List, so that it may now be added to the fauna of this State. Messrs. A. R. McCulloch and E. Le G. Troughton collected a fine three-inch specimen at the Tweed River Heads, New South Wales, in 1912. Austr. Mus. Regd. No. I.12644.

New record for New South Wales.

Family ALEUTERIDAE.

Nelusetta, gen. nov.

Nelus Whitley, Austr. Zoologist, vi, 2, Jan. 14, 1930, p. 179. Orthotype, *Monacanthus vittatus* Richardson, 1846. Preoccupied by *Nelus* Sharp, Zool. Record, xlix, 1912 (1913), Index, p. 12, a genus of Insecta = *Nenus* Navás 1912.

A part of the invaluable Nomenclator Animalium, published in Berlin in 1935, lists *Nelus* as a genus of insects. The name is earlier than mine for a fish, so I propose another new name, *Nelusetta*, with *Monacanthus vittatus* as orthotype. Australian species may now be known as:

Nelusetta vittata (Richardson, 1846).
Nelusetta ayraud (Quoy and Gaimard, 1824).
Nelusetta degeni (Regan, 1903).
Nelusetta hypargyrea (Cope, 1873).

QUEENSLAND RATS OF ECONOMIC IMPORTANCE, AND NEW FORMS OF *RATTUS* AND *THETOMYS*.

By

E. Le G. Troughton, C.M.Z.S.,
Zoologist, The Australian Museum.

Since the latter part of 1935 large numbers of indigenous and introduced Murinae have been submitted for identification to the Australian Museum by the School of Public Health and Tropical Medicine within the University of Sydney, also the Health Department and Bureau of Sugar Experiment Stations of Queensland, and the Colonial Sugar Refining Company, in connection with various investigations relating to the incidence of disease and economic damage in cane field areas, caused by the prolific rat population attracted thereto.

The importance of an ecological survey of the mammalian fauna is emphasized by the fact that no less than six genera of indigenous rats, including eleven species, have been identified from coastal Queensland, of which several are involved as carriers of Leptospirosis (Weil's disease). A great deal of economic loss is caused by the gnawing and breaking down of the cane, which has been vastly increased of recent years by the burning-off necessary to prevent infection, with a corresponding increase in the cost of gathering the crop. It is notable that the two introduced rats have not so far played a part in the cane fields comparable with that of several indigenous species which thrive under the specially favourable conditions. One of these, which may be known as the "Dusky Field Rat", *Rattus conatus*,[1] hitherto tentatively named *R. culmorum*, has apparently assumed the role played by the "Brown" or "Norway Rat" as a reservoir of Leptospirosis in other countries.

The work of identification has been complicated by the absence of original specimens of the old and most of the newly described species, as well as by the very unsatisfactory descriptions, and lack of illustration. The apparently complete disappearance of *R. sordidus* from the Darling Downs region, recent extension of the range of the Swamp Rat (*R. lutreolus imbil*)[2] to southern Queensland, and the coincident range of externally similar species in the north have added to the difficulties of final determination.

The rather bright greyish-brown, relatively small-footed and short-tailed rat, *R. culmorum*,[3] originally described from the Inkerman district south of Townsville as probably "the commonest species of Central Queensland", would actually seem to be of decidedly restricted habitat throughout the wide coastal range accorded it. Specimens of the true *culmorum* have been identified only from the region of Mackay, amongst the extensive series of rats examined from the cane field area, from the Hambleden Mill district near Cairns to Mackay.

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[1] Thomas.—Ann. Mag. Nat. Hist., (9) xii, 1923, p. 159.
[2] Troughton.—Australian Zoologist, viii, 4, 1937, p. 283.
[3] Thomas and Dollman.—Proc. Zool. Soc., 1908 (1909), p. 790.

According to Mr. W. A. McDougall, who has submitted varied series of rats from a wide range of localities on behalf of the Central Sugar Experiment Station at Mackay, the light brown field rat, or true *culmorum*, is quite distinct and, although living together with the dusky field rat (*conatus*), no intergradation of colour has been noted. In view of the much more universal distribution of *R. conatus*, originally described from the Annam River, just south of Cooktown, and recently identified from various cane field areas from Mossman, north of Cairns, to Mackay, it would seem that exceptionally attractive field conditions in the Mackay area have caused the apparently unusual association of the less plentiful *culmorum* with the prolific *conatus*.

Although the occurrence of *culmorum* appears normally restricted to somewhat isolated conditions of habitat, the range was vastly extended inland and to the south in 1921 by the description of the geographical races *R. culmorum vallesius* from the Upper Darling River region of New South Wales, and *R. culmorum austrinus* from Eyre's Peninsula, South Australia. In addition to these races of Oldfield Thomas may be added his *Rattus youngi*, described in 1926 from Moreton Island, off Brisbane, as "no doubt related to *assimilis*". The decidedly smaller foot, shorter tail, and more inflated tympanic bullae, however, definitely ally it subspecifically with *culmorum*, as shown in the Check-list of Mammals,[4] which may be consulted for general references. Examination of a specimen from the extremity of Cape York, received in exchange from the British Museum in 1923 as being quite representative of the typical Inkerman series, shows it to possess various differences to be expected from the marked disparity of habitat, warranting description as a distinct race.

Examination of the unique types of *Rattus sordidus* at the British Museum during 1930, and consideration of the extensive northern coastal range of *R. assimilis* and *culmorum*, leaves little doubt that the dusky brown *R. conatus* actually represents the northern race of the sombre "lost" *sordidus* of the Darling Downs. Topotypical specimens of Cooktown *conatus* are decidedly lighter, but there is a progressive darkening southward to Mackay which confirms the probable relationship, though personal measurements of the typical crania of *sordidus* would indicate subspecific distinction, on account of the larger molars, more slender nasals, and other proportions.

Pending re-discovery of the Darling Downs animal, or examination of intermediate specimens from south of Mackay, it appears desirable to retain the specific distinction of *conatus*, as simplifying field investigations and the tabulation of research. This view is further supported by the apparent discontinuance of the range of the Eastern Swamp Rat (*lutreolus*) beyond the Gympie-Maryborough region of S.E. Queensland, and also because the incompleteness of the typical *sordidus* crania prevents a comparison of the character of the bullae.

Further evidence of a general continuity of murine distribution, however, was provided by the recent submission of six specimens of a small pseudomyid rat from Mackay for identification on behalf of the Central Sugar Experiment Station of the Queensland Bureau. Identified as a new race of *Thetomys gracilicaudatus*, described from Oak Creek, "Darling Downs", by Gould in 1845, the specimens are of particular interest in extending the known range of one of the two larger pseudomyid genera some 500 miles to the north-east, apart from adding another species to the cane field list.

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[4] Iredale and Troughton.—Austr. Museum Memoir, vi, 1934.

Interesting comment forwarded by the Assistant Director of the Bureau of Sugar Experiment Stations, Mr. Arthur F. Bell, concerning the small series of what appeared to be another indigenous species of *Rattus*, stated that specimens were occasionally taken when collecting *R. conatus*, their native habitat being similar. So far, it was noted, "the largest male found (one with testes well down) weighed 66 gms. A male '*culmorum*' [= *conatus*] may weigh as high as 207 gms., although the usual weight of a well-fed old male is 175–195. The brown '*youngi*' [= *culmorum*] in weight, is more or less between the two". It is notable, therefore, that an average difference in weight supports the distinction between the light and dark short-tailed field rats occurring coincidently in the Mackay region.

Apart from providing assistance to the various Departments investigating cane field problems, and also the Colonial Sugar Refining Company, examination of material submitted by the various research officers has resulted in most important additions to the Australian Museum collection. The most interesting acquisition resulted from the identification of the second known specimen of the "False Water Rat", *Xeromys myoides*, from a swamp in the Mackay district. The peculiar annectant form was originally described from a single specimen in the Godeffroy (Hamburg) Museum in 1889, from the same region, and the discovery of the second specimen should provide interesting data for future publication.

It is hoped to conserve sufficient material to complete study series for the various research departments and museum, and in this regard due acknowledgment is tendered Mr. W. A. McDougall, M.Sc., Assistant Entomologist, Queensland Bureau of Sugar Experiment Stations, for his activities in providing varied and adequate series of cane field Murinae. Sincere appreciation is also expressed for the loan of topotypical specimens by the British and Queensland Museum authorities, and especially to Mr. T. C. S. Morrison-Scott, B.Sc., A.R.C.S., Assistant Keeper of Zoology at the British Museum, for kindly providing notes upon the type specimen of *Thetomys gracilicaudatus*.

Rattus culmorum apex, subsp. nov.

Diagnosis.—A much more coarsely spinous race, with generally similar external dimensions, but with a proportionately shorter tail and longer ear. The skull of the aged female holotype is relatively larger, and definitely distinguished by the decidedly wider palatal foramina and shorter molar row, while the bullae exceed the maximum recorded for the typical race.

General coloration more olivaceous owing to the dense admixture of coarsely spinous hairs, which are of a greenish-yellow tinge nearest colonial buff (Ridgway); more strongly speckled dorsally owing to the mixture of pale spines with the darker bistre brown and usual cinnamon tipping. Underfur greyish-olive above and below, instead of the slate-greyish of the typical form, and combining with the spinous hairs in imparting the more olivaceous general tone. The coarser nature of the pelage is indicated by the more spinous hairing of the belly, which is cream colour tinged with colonial buff.

Dimensions of Holotype.—Old female, field measurements: Head and body 159; tail 122; pes 29; ear 20·5 mm.

Skull.—Greatest length 38·5; zygomatic breadth 19·2; interorbital breadth 4·9; braincase breadth 15·5; nasals 14 × 4; palatilar length 17·5; palatal foramina 7·6 × 2·7; bulla length 9·2; upper molar row, crowns, 6·2; width of m^1 2·1 mm.

Holotype.—Old female skin and skull, No. M.3371 in the Australian Museum collection, from Skull Creek in the extreme north-west of Cape York Peninsula, collected by Robin Kemp in 1913 and received by exchange from the British Museum.

Thetomys gracilicaudatus ultra, subsp. nov.

Diagnosis.—A warmly grizzled yellowish-brown race, lacking the greyish tone of the less tropical typical form. External and cranial dimensions generally similar, but the tail relatively much shorter, according to Gould's description, and the skull somewhat smaller but with larger palatal foramina.

General coloration above speckled yellowish-brown, composed of the clay and dark mummy brown tipping, the light tips becoming paler on the head, rump, and sides where an ochraceous-buffy wash is indicated. Basal fur about deep neutral grey, contrasting with the yellowish-brown tipping of the back, and not providing the paler greyish tone described for the typical race. Belly darkish buffy-grey, without sharp demarcation in adults owing to a continuation of the wash of ochraceous-buff from the sides.

Dimensions of Holotype.—From spirit: Head and body 110; tail 105; pes 26; ear 16 mm.

Skull.—Greatest length 31·4; zygomatic breadth 16·8; interorbital breadth 3·8; braincase breadth 13·4; nasals 12·3 × 3·6; palate length 16·3; palatal foramina 7·3 × 2·1; bulla length 5; upper molar row, crowns, 5·8; width of m^1 2·1 mm.

Holotype.—Adult female skin and skull, No. M.6407 in the Australian Museum collection from the cane field area at Mackay, north coastal Queensland. Part of a series of six specimens presented by the Bureau of Sugar Experiment Stations of the Queensland Department of Agriculture.

Remarks.—Apparently a more yellowish tropic coastal relative of the greyish-brown typical form of the Darling Downs. It appears to be distinguished also by the longer tail, and minor cranial features, though the lack of the basal part of the skull of Gould's original specimen prevents complete comparison, notably of the bulla size. Apart from racial distinction, discovery of the northern colony of the apparently "lost" species is of much interest in extending the north-eastern range of the pseudomyid genus.

THE AGE DETERMINATION OF THE TIGER FLATHEAD, *NEOPLATYCEPHALUS (COLEFAXIA) MACRODON* (OGILBY), BY MEANS OF OTOLITHS.

By

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(Plates xxvii–xxx.)

Introduction.[1]

A glance at the fisheries literature which has emanated since 1870 from the countries where fisheries science has chiefly developed, will show that many years had to elapse before the scientific knowledge of even the most common fish species was sufficient for any very definite application.

One of the most essential studies for estimating fish stocks and over-fishing, and for fish conservation generally, has been the collection of data for determining age. The amount of discussion regarding scales and otoliths of the herring, the cod, haddock, and plaice will indicate that the use of such guides is by no means a simple matter. And the proper estimation of the markings on fish scales, otoliths and skeleton has required a thorough study of the life history, migrations, and general ecology of the fish species concerned.

So far as I am aware there seems little or nothing of this kind available for fish of sub-tropical or tropical regions. The most intensely studied marine fish have been the herring, cod, haddock, halibut, plaice and hake, and the northern European countries with Canada and the United States have been mostly concerned. Their chief fisheries have been in cold waters (except for the tuna and pilchard of California). In the southern hemisphere practically no work of the kind has been carried out.

The present work must, therefore, be regarded not only as a pioneer effort in Australian seas, but an incomplete one. It has necessitated more time in the study of one aspect of the problem than the author wished to spend. The results have shown that such a study is unsatisfactory without a thorough scientific knowledge of the life history and habits of the fish.

Unfortunately, to obtain such information it would have required a fisheries investigation vessel so that material could have been obtained at any time and place, and it would have been most desirable to have had fish marked and measured and set free so that some estimates of growth rates in nature could have been obtained. And our knowledge of the Tiger Flathead—the chief trawled fish of New South Wales—is still so incomplete that it is unwise to say what are the extreme limits of the spawning season. It was only because of its importance, and because our curiosity regarding age determination in these waters was great, that this research was commenced. The results, whilst interesting and very suggestive, are offered as tentative only. It would, for example, have been easier if some smaller specimens could have been obtained, and if confirmatory growth rates had been determined by other means.

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[1] The author is indebted very considerably to the technical skill of Miss I. Bennett, who has been responsible for much of the work in preparing otolith sections. The large numbers of Tiger Flathead required were supplied gratuitously and with care by Red Funnel Trawlers, Limited. Thanks are due especially to Captain S. Mills in this connection. The author has been aided in the publication of this work by funds made available from the Commonwealth Government Grant for Scientific Research.

The whole method of age determination by rings of growth in the case of trees, or of fish by markings on scales, otoliths, or other skeletal structures, depends on the fundamental fact that the growth rate is seasonal. Thus where rings of growth are produced as in trees they may be close together in the slow-growing or non-growing winter season, and wider apart in the quick-growing summer season. It is by counting the number of zones of close or wide rings that the age is measured. Where growth is absolutely uniform, such zones would not be recognizable.

In the case of fish otoliths age determination has depended on an alternation of the opaque and translucent areas visible when investigated by transmitted light—the opaque material is regarded as corresponding to a period of rapid growth and the translucent ring as indicating a season of little growth. (By reflected light the opaque rings appear dead white and the translucent rings appear dark. See Pl. xxvii, fig. 2; pl. xxviii, fig. 17; pl. xxix, fig. 24.)

Now it has been common to speak of the zones on fish scales and otoliths as winter and summer rings, and if such were the case, the time from one winter ring to another would obviously represent a year. The temperature of the sea bottom in the region investigated by us is only a matter of 5° warmer in summer than in winter. The Tiger Flathead is more common in slightly deeper water, but probably the temperatures vary even less in that environment. Of migrations of the flathead we know nothing.

One or two indications have, however, already appeared in the literature, which suggest that differences of temperature are neither the only nor chief causes of differentiated growth rings on the skeletal parts of fishes. In 1910 Schneider held that the so-called winter rings of the herring were due to spawning. Dannevig in 1925 experimented with codling in a rearing pond; the fish were fed in the summer, but had to find their own food from the fauna of the pond in the winter. The highest temperatures were reached between June and August. According to scale readings the greatest growth took place at the time of lowest temperature. Other experiments have shown that feeding produces a more marked effect than temperature change.

It just happens that in the halibut, plaice and cod, three much studied fish from the point of view of age determination, the winter season practically coincides with the season during which the gonads are ripening. There is the probability, therefore, that the so-called winter and summer rings on animal tissues are responses to other rhythms which may happen to coincide with the seasons and not direct effects of the actual temperature of the environment. This will be discussed later.

Now it soon became clear from an examination of the carefully prepared Tiger Flathead otoliths that one could find excellent series of opaque and translucent growth rings exactly as in the otoliths of European fishes so much investigated. In some examples they are beautifully definite and regularly placed in a way suggestive of order. In other cases they are much less regular and, as will be seen later, confusing and difficult of interpretation.

So, growth rings being present, we may proceed to discuss the conditions presented, and to see to what extent there is any periodicity suggestive of a regular seasonal rhythm. We can then glance at the question as to whether, say, an opaque ring means a winter ring or other particular season, or whether the opaque and translucent regions must just be left as the expression of changes in metabolism due to some inherent physiological rhythm or to causes yet unknown.

Technique.

The first attempts to determine the age of New South Wales marine fish species in the Department of Zoology, University of Sydney, were made several years ago under my direction, by the examination of a number of otoliths just as they were taken from the fish. Probably because of the opacity and the rough and irregular form of these structures, and because of the high percentage of "difficult" specimens which we have found in our recent work, it is not surprising that the early studies did not appear hopeful and were given up. Several methods of examination have since been tried. Otoliths have been examined whole, immersed in glycerine, benzol, and Canada balsam respectively. Other otoliths were cracked transversely (across the nucleus) and the sectioned surfaces polished. A third method was to grind sections transversely and longitudinally. But the best method, and the one which we carried out with hundreds of specimens, has been to break off a small piece of the otolith at the anterior end, in order to reduce the total convexity, and then to grind down slightly the concave surface until flat enough to cement with balsam on to a piece of plate glass, using heat. The convex surface of the otolith is next ground slightly until the whole is transparent enough for examination, care being taken not to go far enough to spoil the outer margins. The degree of grinding required is only slight and the process is watched carefully, using a microscope. For the purpose we designed and had constructed a small machine embodying an electric motor (Figure 1). The circles of plate glass with

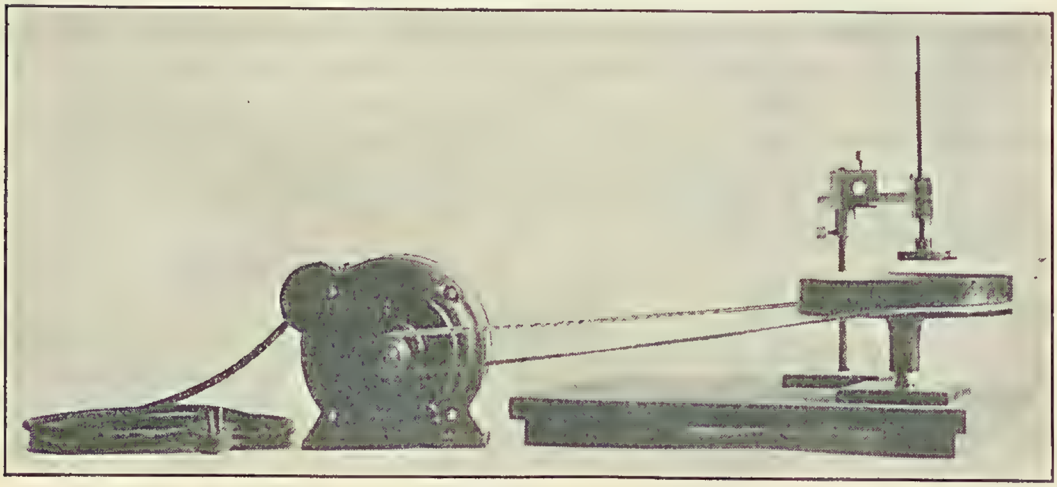

Figure 1.—Grinding apparatus with small electric motor. Carborundum powder is dusted on the plate of glass, and the small circle of glass on which the otolith has been cemented is placed in the holder above it, then lowered on to the plate, and the motor set in motion. The weight of the holder is such that no pressure is needed when grinding.

the attached otoliths were finally warmed up again until the balsam had softened and the otolith removed to an object glass and permanently mounted in balsam.

The Factors Determining Opaque and Translucent Rings.

As pointed out above, most of the age determinations on marine fish by scales and otoliths—one might almost say all—have been made in the north temperate seas and frequently in waters where the winter and summer temperatures were conspicuously different. It has also been customary to find that the fish spawn at a definite season, the spawning period being a limited season of the year. The Petersen method of age determination by length measurements (applied to such an extent in the case of Northern fish species) has depended upon these facts.

One is faced, then, at the very beginning, with the problem of the breeding season of the Tiger Flathead and, strange as it may seem, this apparently simple problem has not proved by any means easy of solution.

Our samples of flathead of all sizes taken through all the months of the year showed some fish with well developed ovaries or testes in practically every month. But rarely were the ovaries in that absolutely ripe condition in which the eggs easily run out on the application of pressure. A. N. Colefax, when measuring flathead and attempting to obtain fertilized eggs on trawler expeditions, only obtained female fish with eggs capable of fertilization during the summer months, but this period probably lasted six months. On the other hand, the fishery inspectors speak of spawning flathead being found in all months, and the same information has been supplied to us by Mr. G. L. Kesteven, B.Sc., of the N.S.W. Fisheries Department. Obviously, if the Tiger Flathead spawns in all months of the year off the coast of New South Wales, the method of determining age by length measurements would be difficult. At the present moment we cannot believe that the evidence produced *does* indicate such a condition. It is mentioned here, however, to indicate the difficulties one is up against where even the most fundamental knowledge of our fish is still inadequate. There is little doubt that the spawning period is extensive. We would suggest from data obtained so far that it extends over at least six months, and that the high period comes between the beginning of October and the end of March.

Reference has been made to the use of the terms *winter* and *summer* rings of growth. Now it is by no means certain that Tiger Flathead are subjected to temperature differences which are sufficient to produce winter and summer rings or to exert a major influence on growth. It was, for example, impossible by an examination of otoliths to find any definite correlation between the most external ring and the season of the year when the fish was taken. Otoliths were removed from fish caught in each season. It was impossible to find any evidence that the winter was the period of growth limitation.

It is important in this connection to refer to a paper in which the conditions presented by fish in the tropics are set out. Erna Mohr in 1921 investigated a number of species, examples of which were taken out of the Zoological Museum of Hamburg. Six species were from fresh water lakes. There are rings on the scales as in fish species from temperate latitudes. Mohr points out the need for more research. She seems to suggest, however, that possibly the spawning seasons are responsible for the rhythmic indications in her examples. Her conclusion is that even if we do not know what causes the different rings in these tropical fish, they can be used for age estimations in fishery science.

It has been pointed out that Dannevig experimented with codling in a rearing pond and found that rapid growth periods could be produced more easily by modifying the feeding conditions than by the alternating seasonal temperatures, and Gray and Setna (1931) have shown that for the Rainbow Trout feeding is a most important feature in determining growth rate.

Bhatia, too (1932), found that in Rainbow Trout there were no "periodic rings" on the scales when the fish were *fed uniformly.* Under these modified circumstances and notwithstanding the temperature, so-called summer rings could be produced in the winter.

Harold Thompson (1926) also showed that the growth rate of haddock was increased considerably by plentiful supply of food given to fish in tanks, and that abnormal growths on scales could be produced in this way.

M. P. Chevey concludes that the evidences of seasonal rhythms on the scales of fish taken in tropical waters at the mouths of the Mekond and Bassoe Rivers are due to alternations of good seasons with abundance of food, and relatively bad seasons, and that this is due to a congregation of fish, etc., at each season of flooding of these rivers, which bring down enormous quantities of nitrogenous matter. He then refers to similar rhythms seen on scales of fish from the lakes and rivers of Cochin China, and suggests the occurrence of good and bad seasons—"un véritable hiver physiologiquement parlant". No experiments are indicated and curiously enough no reference whatever is made to breeding seasons.

But seasonal food conditions are not the only factors which can affect growth.

A recent paper by Hickling (1936) shows not only how there is a seasonal cycle in the weight and condition of the somatic tissues of mature fish, but affirms that in the hake these seasonal changes are foreshadowed in the immature fish, both in the gonad and somatic tissues. This foreshadowing of a seasonal rhythm had been previously suggested by Graham, Russell and Ramalho for cod, haddock and pilchard.

Hickling states that immature fish show a loss of condition at the same season that the adults are losing condition owing to a ripening of the gonads. The bearing of this on the rings of growth on otoliths is most interesting. Thus it is pointed out that Graham (1928) (who made an exhaustive study of the literature), concludes that in "no species of fish has a satisfactory relation been shown between conditions in the external environment and the modification in the growth of the skeletal structures which manifests itself as a growth ring". Graham is inclined to think that growth rings in the cod are due to an internal factor. Dahl in 1907 implied the same thing by speaking of a physiological winter.

There can be no doubt about the occurrence of alternations in growth rates in the life history of the Tiger Flathead, and from the otoliths there is pretty good evidence that there is a fundamental regularity in rhythm, although, as in other fish, it can be disturbed. The theory of Graham, supported by Hickling, appeals to the present author as that which best fits the conditions elucidated at present.

It may be suggested that there is just as much likelihood that the translucent ring (the one so often called a *winter ring*) represents the season when the gonads are approaching ripeness as that it indicates anything else. And for the present it will be assumed that a regular alternation of opaque and clear rings represents the alternation of breeding and non-breeding seasons. Then the possibility of spawning in different months or/and under different conditions of food supply and temperature might well account for the variations seen in individual otoliths. In other words, the rings are not due at least directly to the environment, but to physiological stresses of the spawning cycle.

Description of the Otoliths of the Flathead.

After the examination of a very considerable number of otolith preparations, it was possible to set on one side a number in which more regularly spaced zones were found. An examination of these indicated that the centre of the otolith was marked by an oval rather opaque nuclear region, often with an uneven 'tail' projecting anteriorly. (All otoliths presented a more pointed anterior end and almost invariably the rings towards this end were more irregularly drawn out and difficult to interpret. The posterior portion, actually more than two-thirds of the otolith, is the best part for examination.) In a large number of the good examples (both sexes being included and taken from different seasons of the year) the actual length of the nuclear region was pretty consistent and in the neighbourhood of 4·5 to 5 mm. in length. Sometimes it was less and sometimes more. There seemed, however, to be more chance of interpreting the growth rings (i.e., they were more regular) when the length of the nucleus was about 4·5 mm.

The nuclear region is surrounded by the *first* translucent ring (comparable with the first winter ring in the plaice). We have never had a fish small enough to give this amount and no more. Our smallest Tiger Flathead was 15 cm. in length, and so far as we are aware no smaller specimen exists in any collection. Considerable effort was made to obtain smaller specimens, and it was thought that the Danish seiners fishing in shallower coastal waters might obtain some. We received baskets of very young flathead from them as the result of this request for help. But, alas, all were of a different flathead species! We have, then, no flathead of the "0" year group.

By analogy with the results of other workers, we might assume that the beginning of deposition of the next ring, the first opaque ring, marks approximately the first anniversary after hatching. A fish with an otolith presenting a nucleus, a clear ring and the beginning of the first opaque ring would then be about 15 months old. This condition seemed to be reached in fish ranging from 15 to 22 centimetres in length (Pl. xxvii, figs. 2-6). The next opaque ring begins 12 months later in fish ranging between 27 and 29 centimetres, so the length between 15 and 26 centimetres can represent the I group.

The assumption made above depends amongst other things on the reading that one opaque and one translucent ring are laid down in a year, and this leads to the matter of otoliths where the conditions are not clear.

The number of otoliths in which there is less regular alternation of opaque and translucent rings is a large percentage, so much so that it would be very difficult to interpret the meaning of an otolith, as is done in this paper, unless a considerable number of examples were examined. Probably amongst the variability which occurs, the most constant feature is to find an obliteration of one or more of the translucent rings. (The occurrence of 'false' translucent rings is also to be noted as in other well-known cases.) The tendency is thus for the greater part of the more central part of the otolith to be opaque, which means, we take it, that the growth period is more prolonged in these examples.

Thus the first translucent ring to be seen may actually represent the second one or even the third (see Plate xxvii, figures 8, 9, 10, 18, 26, 27). It is remarkable, however, how frequently the distance of these later growth rings from the centre of the nucleus agrees in older otoliths, and if the distance in millimetres is measured from the centre of the nucleus a little help can be obtained in the identification of the growth rings. Gradually, and after making a series of observations, a rough scale for the positions of the different rings was acquired.

Accepting the above, the following scheme is suggested as an interpretation of the otoliths:

Length of Fish in Centimetres.

15–22	23–26	27–29	30–33	34–35	36–38	39–40	41–44	45	51
1st opaque ring in varying stages of thickness.	1st opaque ring complete.	2nd opaque forming.	2nd opaque complete.	3rd opaque ring forming.	3rd opaque ring complete.	4th opaque forming.	4th opaque complete.	5th opaque forming.	Difficult to decide after 6 years.
I Group		II Group		III Group		IV Group		V Group	

The age of a large Tiger Flathead is thus 5 to 6 years or more. The largest fish that we have had since otoliths were being collected was 55 centimetres in length. At this size the otolith shows rings beyond an age of six years, but it would be unsafe to say definitely whether such a fish was more than eight years of age, if that. In other words, the maximum age is not definitely to be stated. A fish of 67 centimetres was measured by Colefax. It was regarded as exceptional by the trawlermen. Several fish at 65 centimetres were measured, this size also being regarded as exceptional. Whilst, as indicated later, the large females above 50 centimetres are not common, it must be distinctly remembered that the Tiger Flathead is a fish of the deeper coastal waters, and that since catches are practically limited to the grounds at present fished by trawlers, it does not follow that an accurate estimate of the number of large fish can be made. The trawlers are practically always inside the 100 fathom line.

Our figures indicate that the annual increment in growth of the fish is as follows. The length range between the second and third years of age is about 7 centimetres, and for fish of approximately 37 centimetres in length the next year's growth would add about 5 centimetres. Once again it may be stressed that these figures are all regarded as tentative. They are the first suggestions put forward for an Australian marine fish species, and are based on one type of age reckoning alone. It now remains for a fuller biological study of the Tiger Flathead to determine by other methods whether the system adopted here is applicable.

It may be argued, however, that the figures obtained do not seem unreasonable. Incidentally they are valuable as indicating the extra viability of the female (see later), and they show that the fish are on the trawling grounds and are caught first at approximately 12 to 15 months old, the size then being 15 to 22 centimetres.

At this age and size it is not possible to distinguish the sex by the reproductive organs; they are quite immature. The legal minimum size is at present 13 inches (33 centimetres), at which length the fish are, according to our estimates, about 2 to 2½ years of age. The most usual size in the markets is probably round 38 to 40 centimetres.

A glance at some of the illustrations might make it appear that the estimating of age by the otoliths is not so difficult. It must be stressed that the more regular ones chosen for illustrating the different years are not always in the majority. Amongst the facts which appear with some certainty is one which helps to show that the alternating opaque and translucent bands are not mere accidents, but are due to very definite factors. This is the surprising resemblance which may sometimes be found between fish of the same size from the same catch. Thus the otoliths from three different fish taken from one catch and nearly resembling one another in size are illustrated (Plate xxvii, figs. 2, 9, and 10). None of these shows a clear first translucent ring. They present very similar characteristics. It would be possible to deduce that all three fish had experienced similar environmental conditions.

Age and Sex.

In view of the fact that the largest Tiger Flathead obtained by us—size 50 to 58 centimetres—were all females, and in view of the rarity of male flathead of a length greater than 48 centimetres, a distinct possibility of a differential growth rate follows. It is not uncommon amongst fish for the female to grow faster than the male. On the other hand it is possible that the differences in the sex ratio of the largest sized flathead might be due to a differential death rate. As there was some indication at first that smaller flathead were usually males (information received), we commenced our work with some expectation of a difference in the growth rate in the two sexes.

It was interesting, therefore, to find that the otolith readings gave no indication of any considerable differences between the two sexes in regard to speed of growth. So far as we can judge at present from our material, there is little difference between the growth rings of otoliths from male and female flathead up to 45 centimetres in length.

These findings receive further support from observations made by Mr. G. L. Kesteven and kindly communicated by him. He has found not only that equal numbers of males and females are found in the smallest size groups at which the sexes can be distinguished by the gonads, but that in the intermediate sizes the numbers of males and females are also approximately the same.

It seems necessary, therefore, for us to conclude that the length of life is greater for females, or that growth continues to a greater extent in that sex after the length of 45 to 50 centimetres is reached.

As we have previously noted, it is not easy to determine the age by growth rings after a size of 52 centimetres is reached. Beyond indicating that the female flathead probably attains a greater age than six or seven years, we should not like to go. In short, the maximum cannot be definitely stated. It is, however, not of so much consequence in practice, for it would apparently be rare for flathead on the present fishing grounds to reach the maximum possible. It is, however, always conceivable that larger and older Tiger Flathead may occur in greater numbers in deeper water.

The suggestion that the female flathead is more viable than the male, and that it attains a greater age and greater length, is not something unusual in fishes. It is not claimed, however, that this has been definitely proved. Once again it is necessary to point out that without a *complete* knowledge of the life history of the Tiger Flathead, many sides of the story must be left for future workers.

For example, it is not fair to judge the conditions of fish over 50 centimetres in length whilst the fishing area remains restricted. Maybe it is improbable that the present picture of sizes will be changed, but the writer would very much like to know something of the oceanic limits of range of this fish.

Again, there are species of fish in which the sexes grow at practically the same rate for the first two years and then a greater and greater discrepancy occurs. At present, however, we could not accept this as applying to the Tiger Flathead unless something of this sort occurs after the debatable regions of the otolith beyond the fifth opaque ring had been reached, i.e., in fish over 50 centimetres in length.

Conclusions.

1. An examination of a large number of otoliths of the Tiger Flathead, a commercial fish taken by trawlers off the coast of New South Wales, shows that the otolith presents periodic rings of growth.

2. Despite a large percentage of variable specimens and others difficult of interpretation, there is evidence to indicate that a regular seasonal rhythm is present.

3. This seasonal rhythm can be used for an estimation of age.

4. The Tiger Flathead would appear to fall into the following age groups at approximately the sizes indicated:

Age Groups ..	0	I	II	III	IV	V
Length .. Cms.	0–15	15–26	27–33	34–38	39–44	45

(*Note*: The above is a tentative scheme, see discussion. The range of variation in length is greater than indicated, but a complete statistical study to determine this has not been made.)

5. The so-called "winter rings" are not to be classed as indicating the winter season. There is insufficient evidence to show what is the chief factor determining the seasons of limited growth, but for the present it has been taken that the season when the clear ring is normally laid down represents the season when the gonads are approaching maturity or, in the immature fish, a foreshadowing of this season.

6. There appear to be no sexual differences in growth rate or age length until the size of 50 centimetres is being reached. Over the 55 centimetres there appears to be a far greater frequency of females. It is suggested that this is due to a greater viability of the females, although reasons for further investigation are indicated.

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EXPLANATION OF PLATES.

Otoliths from the Tiger Flathead, *Neoplatycephalus* (*Colefaxia*) *macrodon* (Ogilby).

Plate XXVII.

Fig. 1.—An unground otolith from a female fish 55 centimetres in length.

Fig. 2.—Ground otolith from fish of 19 cm. length. (Interpreted as indicating nucleus and part of 1st opaque ring.)

Fig. 3.—Ground otolith from fish 20·5 cm. in length. Female. Nucleus + almost complete 1st ring.

Fig. 4.—Ground otolith from fish 23·0 cm. in length. Female. Nucleus + 1st opaque ring.

Fig. 5.—Ground otolith from fish 26·1 cm. in length. Male. Nucleus + 1st opaque ring.

Fig. 6.—Ground otolith from fish 24·0 cm. in length. Female. Nucleus + 1st opaque ring.

Fig. 7.—Ground otolith from fish 24·1 cm. in length. Male. Same age as Fig. 6, but with secondary rings.

Fig. 8.—Ground otolith from fish 25·0 cm. in length. Female.
Fig. 9.—Ground otolith from fish 26·3 cm. in length. Female.
Fig. 10.—Ground otolith from fish 26·5 cm. in length. Female.
} Similar otoliths from fish of same size and catch, but nucleus larger than usual in all.

Fig. 11.—Ground otolith from fish 27·0 cm. in length. Female. Nucleus + 1st opaque and nearly complete 2nd ring; fish taken in month of June.

Plate XXVIII.

Fig. 12.—Ground otolith from fish 30·6 cm. in length. Male. Nucleus + 2 opaque rings and with translucent margin.

Fig. 13.—Ground otolith from fish 30·5 cm. in length. Male. Nucleus + 2nd opaque just complete.

Fig. 14.—Ground otolith from fish 33·0 cm. in length. Male. Nucleus + 2nd opaque ring and clear marginal ring.

Fig. 15.—Ground otolith from fish 34·6 cm. in length. Female. Nucleus + 2nd opaque ring and clear marginal ring.

Fig. 16.—Ground otolith from fish 36·7 cm. in length. Female. Nucleus + 2nd opaque ring and trace of 3rd opaque commencing.

Fig. 17.—Ground otolith from fish 37·0 cm. in length. Female. Nucleus + 3 opaque rings, 3rd not yet complete.

Fig. 18.—Ground otolith from fish of 36·0 cm. in length. Female. Nucleus + 3 opaque rings by comparison, but example of difficulty in that 2nd translucent ring is apparently missing.

Plate XXIX.

Fig. 19.—Ground otolith from fish 36·5 cm. in length. Female. Nucleus + 3 rings, but nucleus unusually small.

Fig. 20.—Ground otolith from fish 36·2 cm. in length. Female.
Fig. 21.—Ground otolith from fish 36·3 cm. in length. Male.
Fig. 22.—Ground otolith from fish 38·0 cm. in length. Female.
Fig. 23.—Ground otolith from fish 39·3 cm. in length. Female.

Probably all equivalent to otoliths with nucleus + 3 opaque, but obscure types through secondary rings and irregularities.

Fig. 24.—Ground otolith from fish 38·8 cm. in length. Female. Probably nucleus + 3 opaque, but 2nd and 3rd opaque rings not clearly defined.

Fig. 25.—Ground otolith from fish 38·7 cm. in length. Female. Probably nucleus + 3 opaque rings, but very small nucleus and secondary translucent rings in nuclear region.

Plate XXX.

Fig. 26.—Ground otolith from fish 39·0 cm. in length. Female. Probably nucleus + 3 opaque rings, but 1st translucent ring not well defined.

Fig. 27.—Ground otolith from fish 41·1 cm. in length. Male. Nucleus + 4 opaque rings, 1st and 2nd translucent rings not well defined.

Fig. 28.—Ground otolith from fish 45·0 cm. in length. Female. Nucleus + 5 opaque rings. (Indicated by five short black strokes on left side of photo.)

Fig. 29.—Ground otolith from fish 51·0 cm. in length. Female. Nucleus + 6 opaque rings.

Fig. 30.—Ground otolith from fish 54·0 cm. in length. Female. Nucleus + 5 distinct opaque rings + undeterminable margin.

Fig. 31.—Ground otolith from fish 55·5 cm. in length. Female. Probably nucleus + at least 6 opaque rings. First 4 rings distinct and then large undeterminable margin.

(*Note*: In most cases the photography is by transmitted light, and the photograph shows the nucleus and rings representing active growth periods as dark regions; in a few cases, increased surface light has produced the opposite effect, that of a photo by reflected light, and the nucleus and opaque rings show white. This is the case in Pl. xxvii, figs. 2-3; Pl. xxviii, fig. 17; Pl. xxix, fig. 24, and Pl. xxx, fig. 26.)

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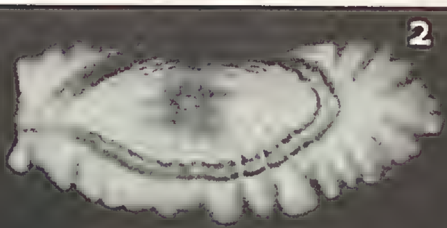

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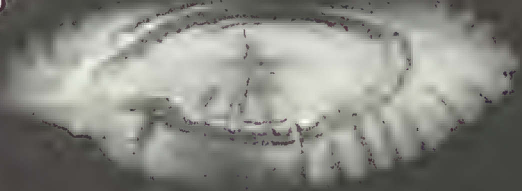

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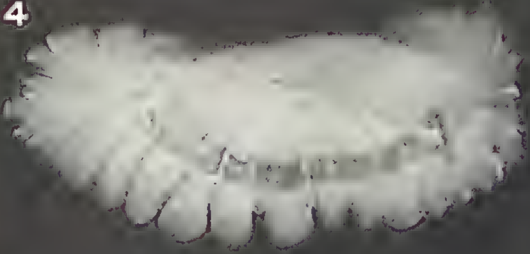

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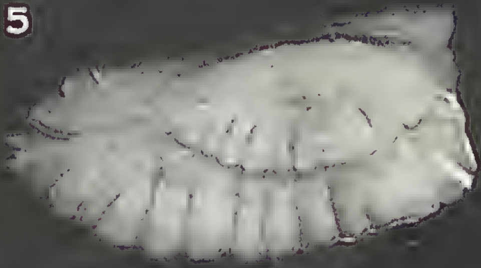

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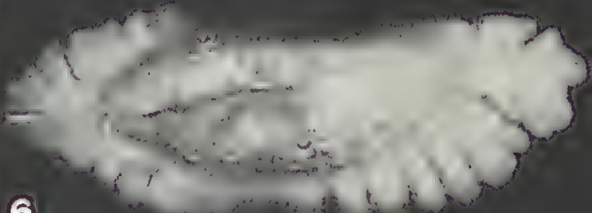

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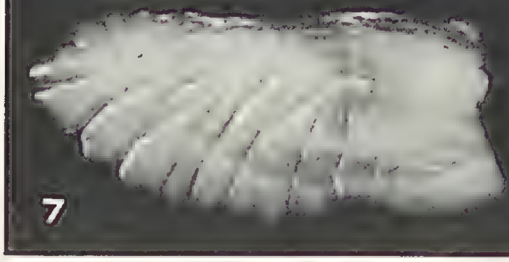

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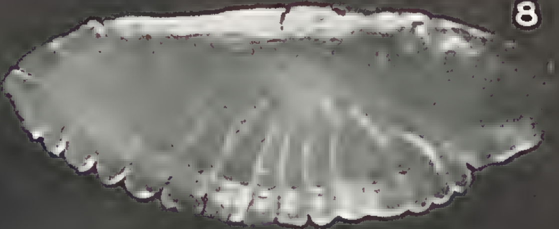

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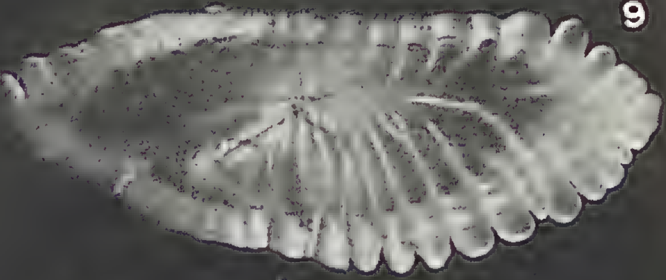

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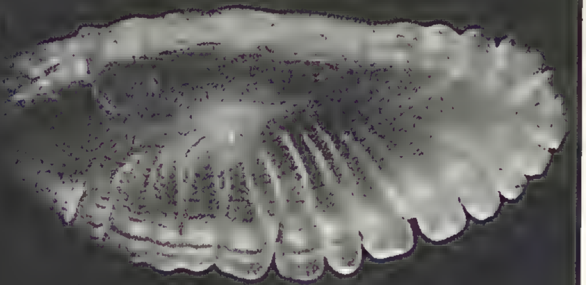

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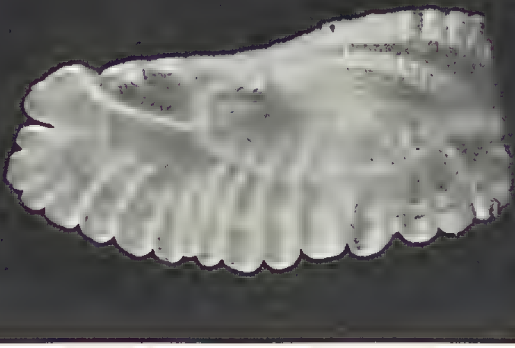

Miss A. G. Burns and W. J. Dakin, photo.

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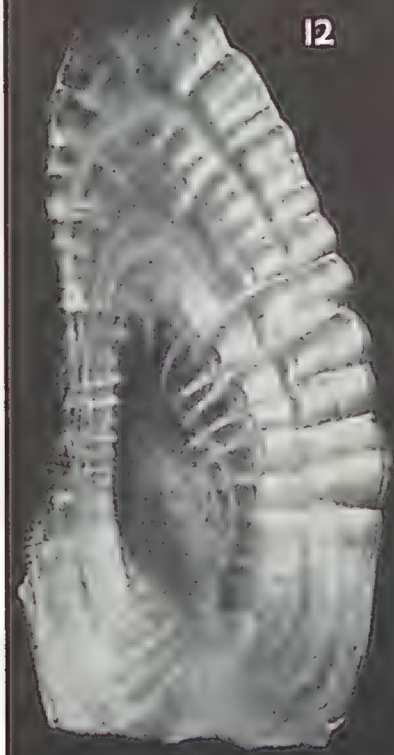
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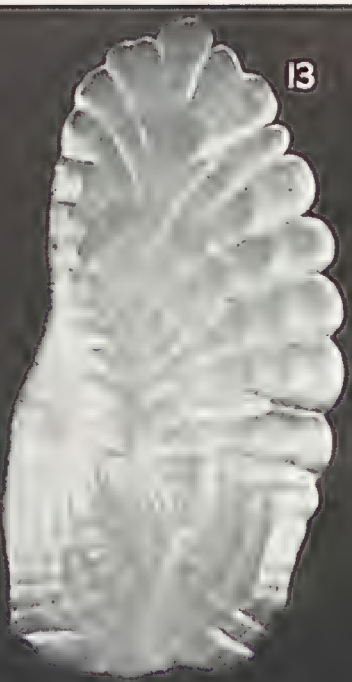
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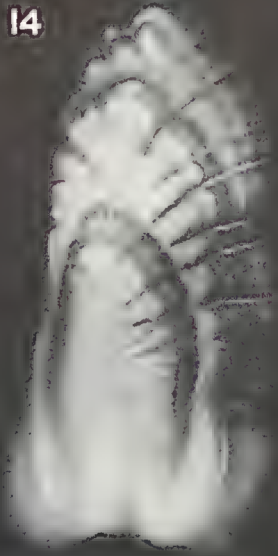
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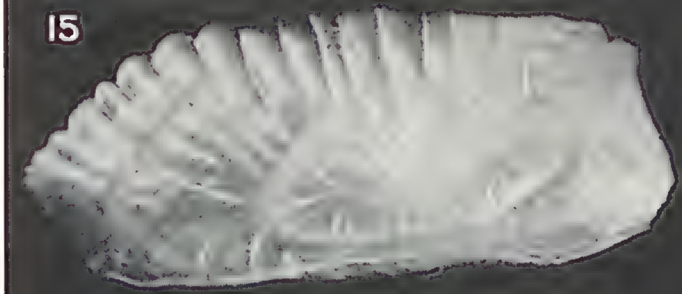
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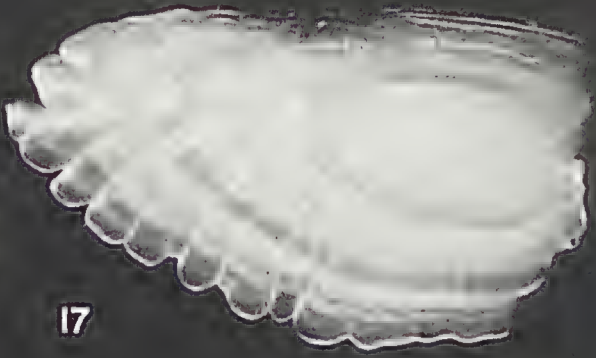
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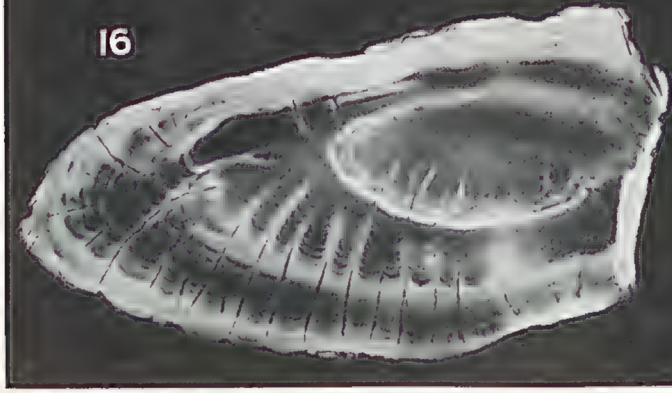
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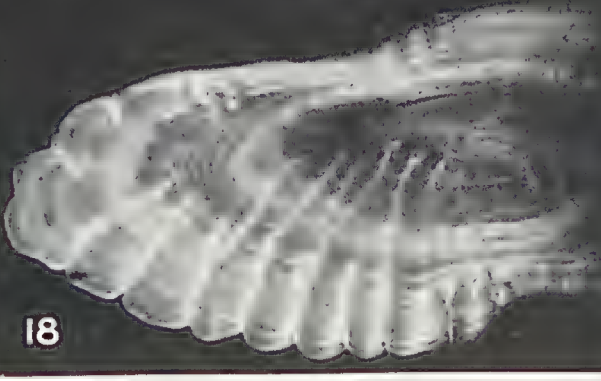
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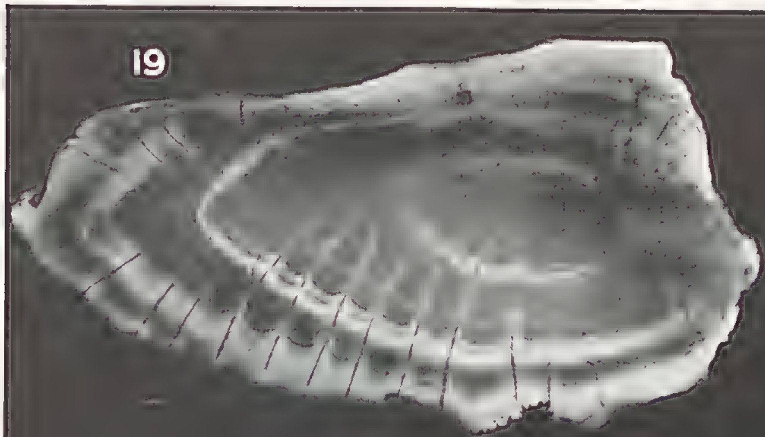

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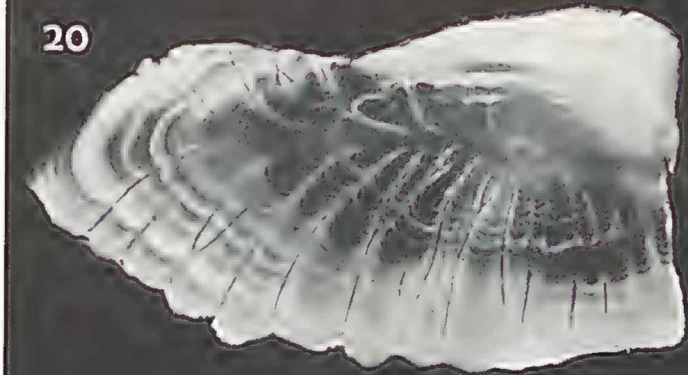

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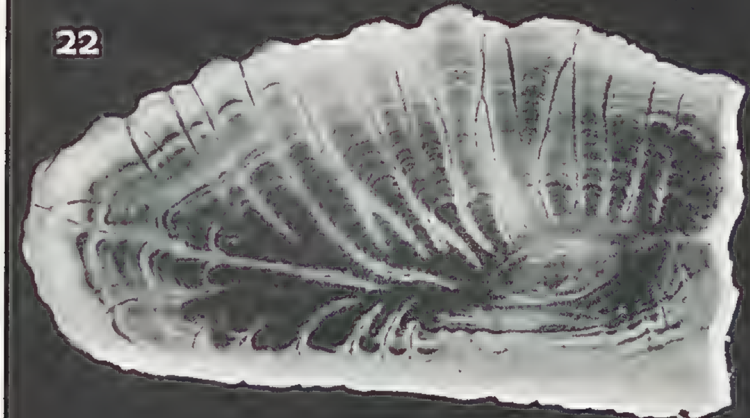

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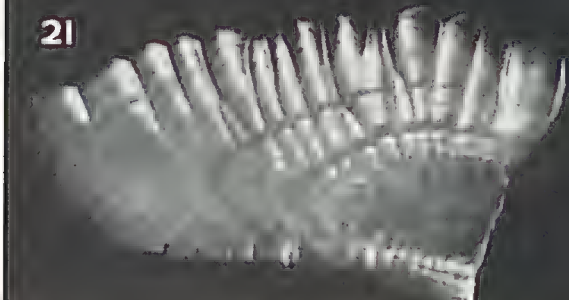

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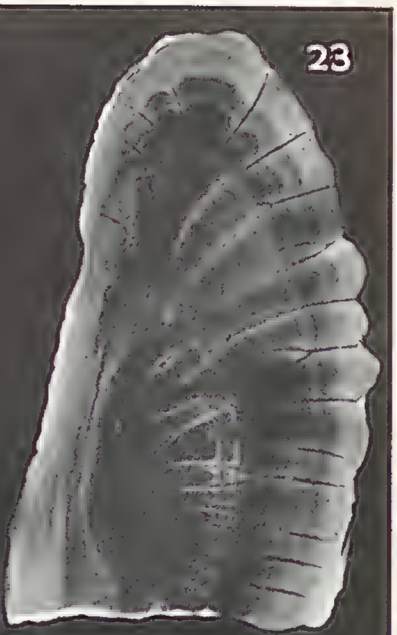

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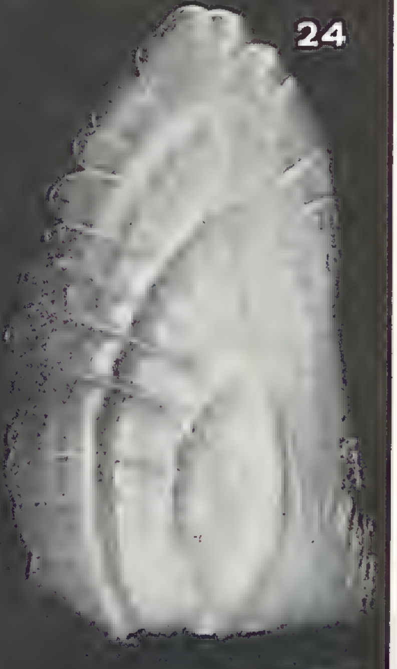

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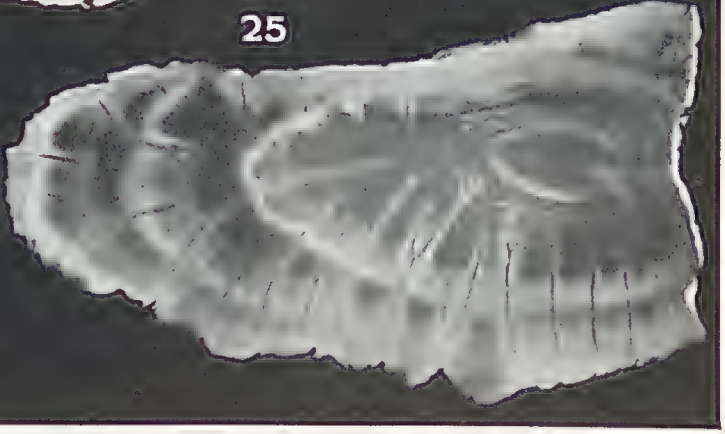

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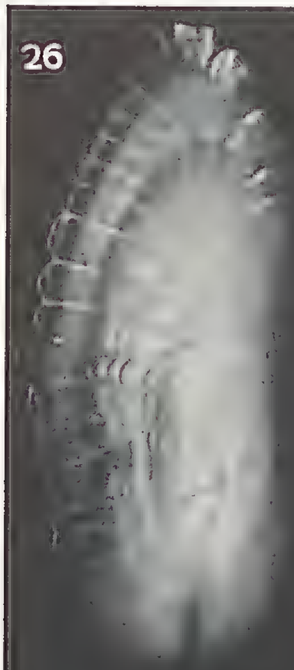

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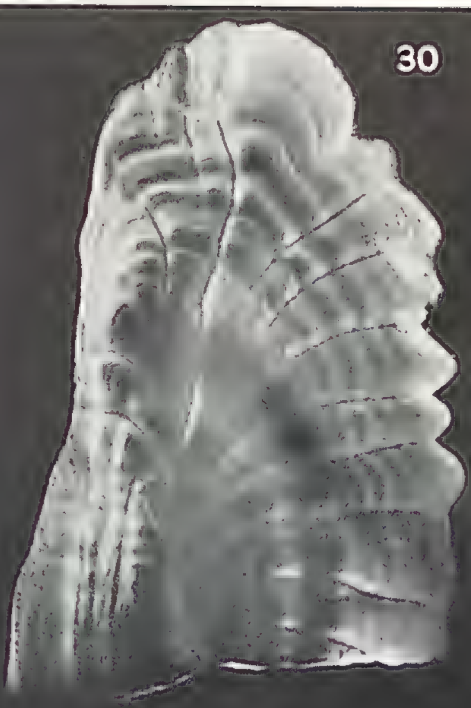

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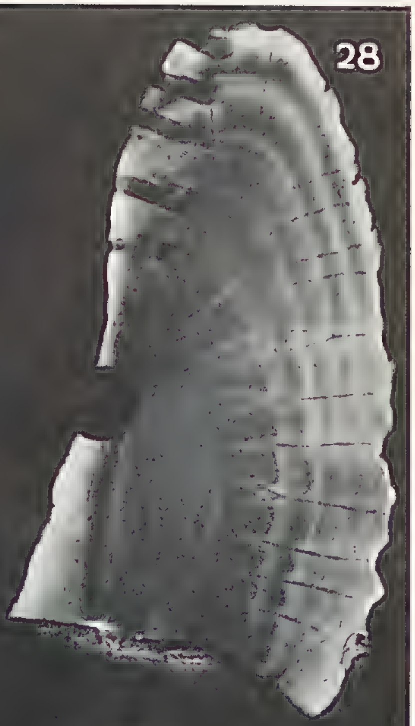

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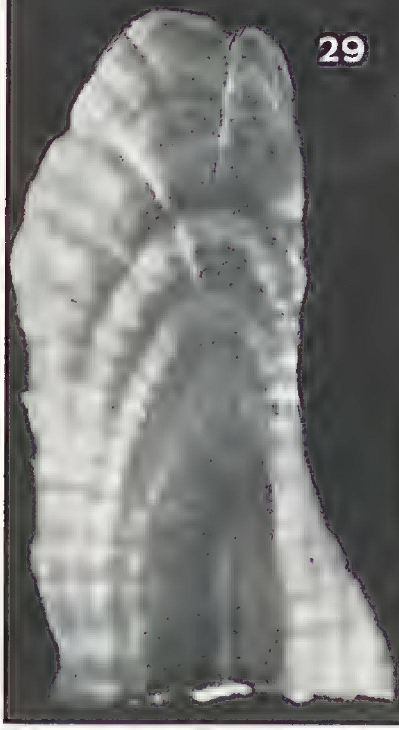

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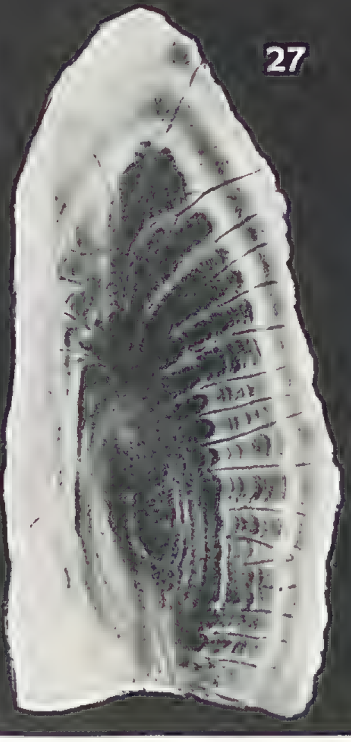

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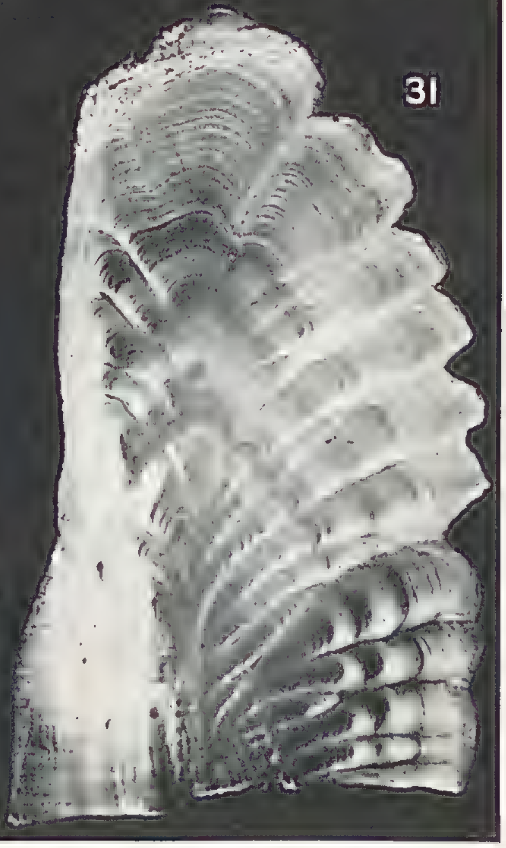

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28 MAR. 1940

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NOTES ON AUSTRALIAN CERAMBYCIDAE.

V.

By

KEITH C. McKEOWN,
Assistant Entomologist, The Australian Museum.

(Plates xxxi–xxxii.)

The present paper contains further results of a critical examination of material in the entomological collection in the Australian Museum, Sydney, together with that submitted for examination by other museums and departments. The work already carried out indicates that considerable unworked material of the greatest interest still awaits study, also that in certain genera a state of confusion exists that is really deplorable.

The accompanying notes consist of descriptions of a number of new species, together with comments on the synonymy of others.

Genus Xystrocera Serville, 1834.

Xystrocera globosa (Olivier), 1795.

There are two specimens which I take to be this insect, from north-west Australia, in the Australian Museum collection. They do not appear to differ in any respect from specimens from Egypt, except that those from Australia are considerably smaller. Mr. H. W. Brown informs me that he has taken this longicorn in the north-west of the continent, thus supplying confirmation of the locality.

It is interesting to note that this beetle has been recorded as a serious pest of Lebbek (*Albizzia*) in Egypt. Other species of this genus of trees occur in the north-west and north of Australia, and one or more of these, possibly, forms its host-plant in this country.

The range of *Xystrocera globosa* has been recorded as covering India, Ceylon, Assam, Burma, Siam, Malay Peninsula, Java, Celebes, Philippines, Egypt, Mauritius and Hawaii. N.W. Australia constitutes an addition to our knowledge of its distribution.

The size of the specimens examined is: long. 25 mm., lat. 7 mm.; long. 17 mm., lat. 4 mm. Egyptian specimens: long. 32 mm., lat. 9 mm.

Genus Nerida, nov.

Slender; elongate. *Head* large, produced into a pointed muzzle. *Eyes* large, prominent, reniform, anterior lobe dilated, coarsely granulate; insertion of antennae almost touching anterior lobe. *Antennary tubercles* mediocre. *Antennae*:

basal joint elongate, curved, clavate; joint 5 as long as joints 3 and 4 combined; joints 6 and 7 equal, slightly shorter than 5; 8–11 gradually decreasing in length; joints 3 and 4 apically spined. *Thorax* elongate, cylindrical, somewhat constricted anteriorly, and to a greater degree posteriorly. *Elytra* little longer than head and thorax combined, wider at base than thorax at widest part, broadening apically. *Legs*: femora elongate, slender, basally, strongly clavate at apex; tibiae elongate, slender; tarsi variable, narrow.

Appears to come near Blackburn's genus *Neobethelium*.

Genotype: *N. carabiformis*.

The two small species included in this genus are of such remarkable form that it is somewhat difficult, on a superficial examination, to believe that they are actually longicorns; both species bear a very close resemblance to Carabidae of the genus *Clarencia*.

Nerida carabiformis, sp. nov.

(Pl. xxxii, fig. 3.)

Slender; elongate; brown with pale elytral markings. *Head* large, produced into an acutely-pointed muzzle; eyes large, prominent, narrowly reniform, very coarsely granulate, anterior lobe dilated; insertion of antennae almost touching anterior ocular lobe; antennary tubercles very small and inconspicuous; palpi slender, elongate, stramineous. *Antennae* longer than body, slender, stramineous; basal joint elongate-clavate, strongly curved, nitid; joint 5 as long as 3 and 4 combined; joints 6 and 7 equal, slightly shorter than 5; 8–11 gradually and progressively decreasing in length; joints 3 and 4 with a very long, slender apical spine or seta projecting inwards. *Thorax* elongate (three times longer than broad), cylindrical, swelling slightly on sides, narrowing strongly towards base, slightly constricted before anterior margin, anteriorly strongly emarginate and narrowly punctate, slightly procurved; posterior margin narrowly emarginate, straight; rich ferruginous, black on sides, highly nitid. *Elytra* little longer than head and thorax combined, wider at base than prothorax at widest part, widening considerably to three-quarters length, then acutely tapering; apices acutely rounded; brown, darker on lateral margins, with an indeterminate pale area about basal third of elytron; a large semicircular stramineous area contiguous with suture (forming a rounded patch on both elytra); apices laterally bordered with pale stramineous markings not reaching suture; basal half of elytra sparsely and irregularly punctate, punctures closer and more regular laterally; apical half almost impunctate; sparse erect setae present over elytra. *Legs* rich stramineous, somewhat nitid; femora elongate, slender on basal half, strongly and broadly clavate at apex; tibiae longer than femora, slender; tarsi short, slender.

Long. 9 mm.

Loc.—N. Queensland: Cape York.

Holotype (unique) in Australian Museum, Sydney.

Nerida intricata, sp. nov.

(Pl. xxxi, fig. 11)

Slender; brown. *Head* large, much broader than thorax, constricted behind eyes, produced into an acute muzzle; eyes large, broadly reniform, expanded on anterior lobe, moderately prominent; antennary tubercles inconspicuous; a raised line on each side of head extending from apex of posterior ocular lobe to junction of clypeus, and passing just inside point of insertion of antennae; a short, deeply impressed median sulcus between antennary bases. *Antennae* slightly longer than body; basal joint slender, curved, elongate-clavate; joint 3 slightly longer than 4; 5 as long as 3 and 4 combined; 6–8 equal, shorter than 5; 9 shorter than 8; 10 and 11 equal, shorter than 9; joints stramineous, becoming brown at apices; 10 and 11 almost entirely brown. *Thorax* nitid, cylindrical, broader anteriorly than posteriorly; rather broadly rounded on sides; anterior margin widely emarginate, straight, constricted behind emargination and narrowing strongly behind central expansion to posterior margin which is very narrowly emarginate, straight; disc with two small rounded tubercles placed somewhat anteriorly; colour blackish-brown, except for an irregular pale patch on centre of disc. *Elytra* slightly wider at base than thorax at widest point; approximately parallel to nearly half-way, widening to apical three-quarters before converging roundly to apex; apices acutely rounded; colour rich dark brown with a pale diagonal marking on each elytron forming a wide 'chevron' across both elytra just anteriorly to middle; a rounded black or dark brown spot placed somewhat anteriorly on pale band; 'chevron' margined posteriorly with dark brown; basal half of elytra darkest, apical half paler but not as light as 'chevron'; a sub-apical circular spot of pale yellow-brown margined with blackish-brown; external margin of apices narrowly edged with dingy yellow; basal half of elytra regularly punctate; apical half almost impunctate. *Legs*: femora ferruginous, slender over basal half but becoming strongly clavate on apical half; tibiae slender, elongate (equal in length to femora), pale yellow; tarsi slender, elongate, yellow.

Long. 8 mm.

Loc.—N. Queensland: Cape York.

Holotype (unique) in Australian Museum, Sydney.

Rather similar in form to the preceding species, but very readily distinguished by the tuberculate and relatively broader prothorax, the regular puncturation of the elytra, and distinctive colour pattern.

Genus **Wahn**, nov.

Medium. *Head* large, broad; eyes large, reniform, finely granulate; palpi slender, relatively long, apical joint acutely spatulate; antennary tubercles small, not prominent. *Antennae*: basal joint moderately elongate-clavate; joint 3 as long as 1; 4 shorter than 3; 5 as long as 3; 6–8 approximately equal, as long as 4; 9 shorter than 8; 10 and 11 equal, shorter than 9; apical joint short, rounded. *Thorax* much longer than broad, cylindrical, strongly constricted at base, tumid about centre. *Elytra* parallel, but apex wider than base; apices broadly rounded. *Legs*: femora broadly clavate; posterior femora not reaching extremity of body; tibiae and tarsi slender.

Genotype, the following species.

Appears to come near the preceding genus.

Wahn zonulitis, sp. nov.

(Pl. xxxii, fig. 5.)

♀. Moderately robust; bright ferruginous-red and black. *Head* large, broad, coarsely punctate; eyes large, reniform, finely granulate; palpi relatively long and slender, apical joint acutely spatulate; antennary tubercles small, not prominent.

Antennae not reaching apex of elytra; relative proportions of joints as per generic formula; pale ferruginous; basal joint, apices of joints 5–9, and joints 10 and 11 entirely, black. *Thorax* impunctate, highly nitid, cylindrical, much longer than broad, tumid about half-way, narrowing strongly over posterior third; strongly constricted at base; basally emarginate. *Elytra* about three times as wide as prothorax at base (slightly wider than prothorax at widest point), slightly constricted about basal third, then expanding to apex; apex much broader than base; apices broadly rounded; basal third nitid, finely punctate, bright ferruginous-red; apical two-thirds highly nitid, impunctate, black; red and black areas separated by a narrow white line sloping diagonally outwards from suture and slightly procurved at lateral margin; shoulders prominent; sutural line strongly depressed dorsally over basal fourth. *Legs*: femora broadly clavate, nitid, impunctate, black, yellow at base; tibiae and tarsi slender; tibiae coarsely punctate, black at base, becoming yellowish towards apex; tarsi yellow.

Long. 5 mm.

Loc.—New South Wales: Kurrajong (Masters).

♂. Similar to female, but smaller. *Elytra* tending to brownish basally; *antennae* longer than body.

Long. 4 mm.

Loc.—New South Wales: Otford.

Holotype ♀ and allotype ♂ in Australian Museum, Sydney.

Genus **Pachydissus** Newman, 1838.

Pachydissus magnus, sp. nov.

♂. Robust; dark brown, clothed with silky, golden pile. *Head* relatively small, frons deeply sulcate, a small, narrow, apically-cleft tubercle at base. *Antennae* stout, densely clothed with fine pubescence; joints 3, 4 and 5 of approximately equal length, swollen; 3 and 4 equally tumid, 5 to a lesser degree; 6 slightly thickened apically; remaining joints comparatively slender; joints 7–9 approximately equal, longer than 10; terminal joint of both antennae wanting, but complete length should reach to apex of elytra in a perfect specimen. *Thorax* wider at base than apex, somewhat feebly tuberculate-angulate at centre of lateral margin; disc intricately folded and wrinkled, but without nitid median areas; fringed with long, soft hairs on anterior margin. *Scutellum* cordate. *Elytra* deeply indented at base between shoulder and suture; slightly emarginate suturally on basal fourth; apices sinuate-truncate, strongly unispinose at sutural angle, external apical angle broadly rounded. *Legs* reddish-brown, densely pubescent. *Under-surface* densely clothed with coarse pubescence on sterna, abdominal segments closely but finely pubescent; ventral surface of head with a single, deep, transverse groove behind eyes.

Long. 43 mm, lat. 13 mm.

Loc.—New South Wales: Balranald.

Host Plant.—'In Myall' (*Acacia pendula*).

Holotype in Australian Museum, Sydney.

This fine species is by far the largest member of the genus known to me. It is easily separated from the other described species by the strongly sinuate appearance and deep indentation of the elytral bases, the unispinose elytral apices, and the apical swelling of the third to sixth antennal joints.

The tawny golden pubescence gives the insect a moiré-velvet appearance. In the specimens before me this pubescent clothing is somewhat irregularly abraded, revealing the dark derm beneath, but I have little doubt that in a perfectly fresh specimen it would completely cover the insect. There are indications of two irregular, slightly raised costae on each elytron where the derm is exposed.

Pachydissus sweersensis, sp. nov.

♂. Moderately robust; reddish-brown, sparsely clothed with a fine greyish pubescence. *Head* broad, deeply sulcate between antennary tubercles, but not extending to frons. *Antennae* very slender, one-third longer than body, apex of eighth joint extending beyond extremity of elytra; 3rd joint longer than 4, both equally swollen at apex; 5 longer than 3; 6 longer than 5; 6–11 of approximately equal length, apices not enlarged; terminal joints only lightly pubescent. *Thorax* longer than broad, sides regularly rounded, slightly tuberculate; disc finely and regularly rugose. *Scutellum* small, triangular. *Elytra* suturally and laterally emarginate; apices broadly truncate, bispinose, both spines being equally developed; two faint, slightly raised, longitudinal costae on each elytron. *Under-surface* sparsely pubescent throughout; head beneath with two transverse grooves, one before and one behind the eyes.

Long. 28 mm.; lat. 8 mm.

Loc.—Sweers I., Gulf of Carpentaria.

Holotype in Australian Museum, Sydney.

This species appears to come closest to *Pachydissus nubilus* Pasc., but may be readily separated from that and other species by the length and slenderness of the antennae. In *P. frenchi* Blkb. the antennae are even longer, but are, at the same time, considerably stouter and differ in the tumid joints. These and other characteristics as above will serve to determine the present species.

Genus **Phacodes** Newman, 1841.

Phacodes mirabilis, sp. nov.

(Pl. xxxi, fig. 4.)

♂. Robust; black, densely clothed with creamy-white and ferruginous pile, completely obscuring derm except on tubercles and certain well-defined areas. *Head* large, broad, with an ill-defined median sulcus extending from base to just before eyes; densely clothed with pale ferruginous hair, tending to golden-yellow on clypeus; antennary tubercles not prominent, somewhat transverse. *Antennae* considerably longer than body, brown, stout; basal joint short, tumid, closely punctate, sparsely clothed with grey hairs; second joint strongly conical; 3 about twice as long as 1, with a stout, curved, nitid, black spine at apex, clothed with dense grey hair and fringed beneath with long yellow hairs; 4 slightly half length of 3, spined at apex, clothed with short recumbent hairs, fringed beneath; 5–10 approximately equal to 1; 5, 6 and 7 spined at apex, the latter two joints minutely; 8–10 more slender, unspined; terminal joint elongate, slender, rounded at apex; joints 6–11 pubescent; 1–5 fringed beneath. *Thorax* strongly convex on disc; laterally with two almost straight faces meeting in an obtuse angle when viewed from above, the first running from anterior constriction to a prominent, acute lateral spine a little behind mid-way; the second running somewhat obliquely from spine to posterior margin; anterior and posterior margins straight; disc with five nitid areas, two in the form of tubercles placed somewhat laterally to median line and a little in advance of half-way; behind them an elongated median tubercle, widest in front and tapering behind; two large laterally situated, highly nitid but not elevated areas contiguous with posterior margin; exposed derm black; whole of prothorax, other than nitid areas mentioned above, densely clothed with very pale recumbent, buff hairs, becoming thicker and tending to form broad stripes laterally; nitid median tubercle bordered with buff hair of a much darker and richer shade than general thoracic covering; where thoracic pile is abraded the derm appears closely and finely punctate. *Elytra* broader at base than thorax at widest, parallel, rounding to apex; apex squarely truncate, external apical angle produced in a long, slender, acute spine; sutural angle somewhat acute but not spinose; derm black, densely clothed with short pale-cream pile tinged with bright buff; a median area situated at about one-fourth elytral length, lateral margins, and an area around apical nitid patches, strongly buff. The following nitid areas stand out in more or less strong relief: a closely tuberculate area at base with points of tubercles protruding through pile, a contiguous almost completely nitid area with many prominent and acutely pointed tubercles; a row of small tubercles extending along suture; an irregular, elongate, somewhat ovoid area with a densely pubescent white patch in its centre, near apex; several nitid tubercles of fairly large size scattered over the elytral surface. *Legs*: femora swollen, densely clothed with white pile, apices black; tibiae black with sparse white and buff hairs, spined at apex; tarsi black, sparsely clothed with grey hairs and fringed with bright golden-yellow; claws slender, curved, black. *Undersurface* brown, sparsely clothed with fine greyish pubescence; abdominal segments fringed with yellow hair.

Long. 30 mm.; lat. 9 mm.

Loc.—Queensland: Bunya Mts. (N. Geary), 14 December 1937.

Holotype in Australian Museum, Sydney.

A further specimen received from Mr. A. R. Brimblecombe, Department of Agriculture and Stock, Brisbane, during the preparation of this paper differs from the type in the following particulars: elytral pile with a distinct bluish-grey tint; long. 26 mm.; lat. 7 mm. *Loc.*—Queensland: Yarraman (A.R.B.[rimblecombe]), 5 December 1935, 'on wing, 1 p.m.'

This exceedingly beautiful insect comes near *Phacodes bellus* Blkb., but differs from it by its much narrower and constricted thorax; the lateral thoracic planes, forming an obtuse angle, are both straight, and the posterior plane not sinuate as in Blackburn's species; the prothorax is definitely not 'fortius rugulose punctulata', nor is it granulate towards the sides. If Blackburn's 'lunulate ridges' are the equivalent of the rounded, naked, posterior prothoracic patches of *mirabilis*, these are highly nitid and *not* 'not quite glabrous'; they are most certainly not elevated; the elytral derm of *mirabilis* appears to be unicolorous almost throughout, but is possibly a little lighter towards the lateral margins. The elytral pattern is very distinct, as also is its colour, although, as has been indicated, this is not constant. All specimens seen appear to be males, so that the colour variation is unlikely to be sexual.

The distribution of colour, pilose and nitid areas is so intricate that it is almost impossible to convey any really adequate idea of the appearance of the insect; the very beautiful figure of this insect by Miss N. B. Adams should make clear what may be obscure in the description.

I have before me specimens which I assume to be *P. bellus*. They conform closely to Blackburn's somewhat inadequate description and agree with specimens labelled *bellus* in the South Australian Museum. Both sexes are represented.

Genus Tessaromma Newman, 1840.

Tessaromma sordida, sp. nov.

Slender; reddish-brown; sparsely clothed with light brown, silky pubescence, chiefly concentrated into irregular spots and patches. *Head* with a short, narrow, median sulcus between antennary tubercles, but not extending to base; coarsely punctate, lightly pubescent. *Antennae* not reaching to apex of elytra; ferruginous, finely punctate with scattered, sparse, slender hairs, not pubescent; joint 5 longest, others approximately equal. *Thorax* as long as broad (at widest point), more constricted anteriorly than posteriorly; strongly spined laterally about middle, spines stout, broad at base, apex slender, directed backwards; disc with four slightly raised tubercles placed somewhat laterally, median area wide and smooth; thoracic margins straight, posterior slightly emarginate. *Scutellum* narrower than long, rather acutely pointed posteriorly. *Elytra* scarcely broader than thorax at widest point; parallel, tapering sharply to apex; apices evenly and acutely pointed, divergent; surface of elytron with three rows of large circular punctures extending from base almost to apex; pubescence concentrated chiefly laterally and on shoulders, that on apices interspersed with scattered, long, slender hairs. *Legs* reddish-brown; femora not markedly clavate, finely punctate with scattered hairs. *Under-surface* nitid, finely punctate.

Long. 16 mm., lat. 3 mm.

Loc.—S. Queensland: Mt. Tambourine (A. Musgrave and G. P. Whitley), 19 December 1925.

Holotype in Australian Museum, Sydney.

Superficially rather similar in appearance in certain respects to the following species, but differing in the shape of the thoracic spines and tubercles, the acutely-pointed elytral apices, and the more slender femora. These, taken with other characters, should render its identification simple.

Tessaromma truncatispina, sp. nov.

Slender; cinnamon-brown, irregularly clothed with tawny-golden pubescence. *Head* with a clearly defined median sulcus extending from base to antennary tubercles; densely clothed with short pubescence. Antennae slightly exceeding length of body, densely and regularly punctate, clothed throughout length with a fine golden pubescence interspersed with long, slender hairs, especially on joints 1–5; joint 5 longer than others; 3, 4, 6 and 7 approximately equal, remainder gradually diminishing in length. *Scutellum* broader than long, widely rounded posteriorly. *Thorax* constricted on anterior and posterior margins, sinuate; laterally with a strong, abruptly truncate tubercle or blunt spine about centre; disc with two irregularly elongate and slightly raised tubercles separated by a wide median sulcus. *Elytra* wider than thorax (at widest point), parallel, dorsally flattened, narrowing sharply to apex; apices narrowly rounded, divergent; seriate-punctate in three longitudinal rows, punctures large and rounded, most regular and distinct on basal half, sparse and irregularly apically; irregularly clothed with short brown and golden pile, densest towards sides, interspersed towards apices with long, slender hairs, giving the insect a moiré appearance. *Legs* dark brown, finely and closely punctate; femora elongate-clavate, lightly clothed on sides with pubescence; tibiae coarsely punctate, with mixed yellow and brown hairs; tarsi reddish. *Under-surface* nitid, finely punctate, abdominal segments with a sparse, fine pubescence.

Long. 17 mm., lat. 4 mm.

Loc.—N. Queensland: Bunya Mts. (N. Geary), 5 January 1938.

Holotype in Australian Museum, Sydney.

Comes near *T. sericans* Er., but may be easily distinguished by the narrow, roundly pointed elytral apices and other characters.

Genus **Piesarthrius** Hope, 1834.

Piesarthrius gearyi, sp. nov.

(Pl. xxxii, fig. 4.)

♂. Robust; black. *Head* coarsely rugoso-punctate, deeply and broadly sulcate between antennary tubercles; antennary tubercles not prominent; eyes large protuberant, coarsely granulate. *Antennae* almost twice as long as body, eighth joint reaching to apices of elytra; first joint somewhat tumid, nitid, coarsely and sparsely punctate, remainder of antennae dull pruinose, dark brown; joint 1 shorter than succeeding joints (except 2); joints 3–10 of equal length, flattened, laminate, external apical angle strongly produced into an elongate-foliate extension, becoming longer on each successive joint; interior angle not produced; apical joint longer than preceding, simple without lateral extension, elongate-foliate, widening slightly before centre, then decreasing in breadth to a narrowly rounded point. *Thorax* broadly ovate, anteriorly broadly emarginate, coarsely rugoso-punctate with a narrow nitid tubercle on disc, slightly pilose laterally. *Elytra* nitid, coarsely and irregularly punctate, scarcely broader at base than prothorax at widest, tapering somewhat towards apices throughout length; apices narrowly rounded, unarmed; lateral and sutural margins very narrowly emarginate. *Legs* black, strongly nitid, somewhat sparsely and coarsely punctate with a sparse buffy pubescence, thickest on posterior margins of femora, where it tends to form a definite fringe. *Under-surface* finely and regularly punctate, sub-nitid, with sparse buff pubescence, thickest on abdomen and central line of sterna.

Long. 17 mm., lat. 5 mm.

Loc.—S. Queensland: Cunnamulla (N. Geary), 12 January 1938.

Holotype (unique) in Australia Museum, Sydney.

♀ unknown.

This relatively small but very striking species comes near *P. brevicornis* Aurivillius in general appearance, but is very readily distinguished from this and all other members of the genus by the form of the antennae. The remarkable structure of the antennae might, possibly, justify the formation of a new genus for its reception, but until further material is available for examination, preferably of both sexes, it seems advisable to place it in *Piesarthrius*, with which its other characters conform so closely.

Named after Mr. N. Geary, who has collected so assiduously for this Museum, and from whom many very interesting novelties have been received.

Piesarthrius reticulaticollis, sp. nov.

(Pl. xxxi, fig. 2.)

♂. Robust; piceus-brown. *Head* relatively broad, depressed strongly behind eyes, antennary tubercles small, and but slightly raised, rugose; basal margin coarsely punctate. *Antennae* not reaching extremity of body, reddish-brown, laminate; laminae borne on joints 3–10 (terminal joint wanting), external and internal laminae of equal length. *Thorax* as broad as long, sides very slightly and evenly rounded, posterior and anterior margins straight, anterior emarginate; disc irregularly, deeply and coarsely punctate, punctures confluent, with short, stramineous hairs seated in the pits; a few small, irregular impunctate, nitid areas near centre of disc; sides with a large ovate patch of cream-coloured pile, through which protrude a number of irregularly placed, rounded, nitid, brown tubercles. *Scutellum* triangular, clothed with pale hairs. *Elytra* parallel, tapering slightly towards apex; apices broadly rounded on exterior angle, and with a strong, acutely-pointed spine on sutural line; surface of elytra very coarsely and confluently punctate, giving the insect a rugose appearance; short, pale stramineous hairs seated in the punctures; the whole of elytra of a uniform dark brown with an indication of an irregular area of a paler shade about apical fourth. *Legs* short and stout, piceus-brown, lightly clothed with short, whitish hairs; tarsi fringed with close yellow hair. *Under-surface* clothed throughout with long, adpressed, white pile.

Long. 21 mm., lat. 6 mm.

Loc.—Queensland.

Holotype (unique) in Australian Museum, Sydney.

A very stout, thick-set species, easily distinguished from its congeners by its stature, and the laminae of the antennae, which are of equal length.

Piesarthrius rufoflavus, sp. nov.

(Pl. xxxii, fig. 6.)

♀. Robust; rufus varied with yellow patches. *Head* narrow, coarsely granulate, nitid, clothed with yellow hairs on frons and vertex immediately behind eyes; antennary tubercles prominent; posterior margin finely rugose. *Antennae* about two-thirds length of body, bright ferruginous, nitid, coarsely punctate, sparsely clothed with semi-erect hairs, tending to pubescence on apical portion; joint 1 as long as 3; others shorter and approximately equal in length *inter se*; joints 3–10 acutely angulate exteriorly apically. *Thorax* longer than broad, regularly rounded on sides, dark ferruginous, deeply rugoso-punctate, punctures confluent, with stout, semi-erect yellow hairs seated in punctures; a somewhat oval-shaped lateral area of bright yellow pile extending from base, but not quite reaching anterior margin, a number of large, rounded, nitid tubercles protrude through this pilose clothing, giving a speckled appearance; basal and anterior margins straight, lightly emarginate. *Scutellum* triangular, pilose. *Elytra* wider than base of thorax, parallel, broadly rounded on exterior apical angle with an acute sutural spine deflected strongly inwards; about the centre of each elytron, a triangular area of bright yellow with its base on lateral margin and its apex towards but not reaching suture; surface of elytra coarsely, and frequently confluently, punctate; on the yellow areas the punctures are sparse and not confluent; a semi-erect, pale stramineous hair is seated in each puncture over the whole surface of the elytra; suture and lateral margins narrowly emarginate; the colour of the derm anteriorly to the yellow patches is darker than that apically, this also tends to become paler towards the sides. *Legs* dark piceus-brown, nitid, with scattered pale stramineous hairs. *Under-surface*: sterna clothed with whitish pubescence; abdomen light ferruginous, nitid.

Long. 30 mm., lat. 8 mm.

Loc.—Queensland: Dawson River; without locality (G. Barnard), from South Australian Museum.

Holotype in Australian Museum, Sydney.

In a genus in which there is such marked sexual dimorphism, I am reluctant to describe a species on female specimens alone, but an exception is made in this instance as the insect is so strikingly distinct from all other described forms, for there seems to be no risk of confusion. On the analogy of the other species of the genus the male, when discovered, should possess a very similar combination of colour and pattern.

Genus **Coptopterus** Hope, 1834.

1834.[1] *Stronglurus* Hope.

Coptopterus decvoratus, sp. nov.

(Pl. xxxi, fig. 6.)

Robust; pale ferruginous marked with black. *Head* brownish-black, coarsely punctate, frons, apex, and antennary tubercles with a sparse clothing of coarse, stramineous hairs, extending round margins of eyes. *Antennae*: basal joint stout, nitid, sparsely punctate, with scattered coarse hairs; joints 3 and 4 closely and finely punctate with a moderate clothing of hairs (finer than on 1); following joints densely pubescent; 3, 4 and 5 with coarse, bristle-like hairs at apex; 3 slightly longer than 4; 4–7 of approximately equal length; 8–11 short and progressively decreasing in length. *Thorax* nitid, almost as broad as long, broadly rounded anteriorly on sides, slightly constricted posteriorly; thoracic margins lightly emarginate, somewhat sinuate; disc deeply and confluently rugoso-punctate, sparse creamy hairs seated in punctures; an impunctate median line becoming widest just beyond centre of disc, where it terminates; disc ornamented with five small patches of white pubescence, consisting of two anterior, laterally-situated diagonal patches of creamy pubescence, and three longitudinal basal patches, two lateral and one median. *Scutellum* strongly rounded apically, clothed with dense cream pubescence. *Elytra* strongly nitid, pale ferruginous; parallel, apices with a short sutural spine; a curved, somewhat diagonal black linear marking, widening posteriorly, running from near shoulder to suture at about anterior fourth; a forward-pointing Λ-shaped broadly linear black chevron at centre extending from lateral margin to, but not quite contiguous with, suture; a broad black marking running from median line of elytron inwards to suture near apex, and coalescing with lateral margin which is narrowly black throughout; suture narrowly edged with brown; suture and lateral margin narrowly emarginate; basal half of elytra to second black marking coarsely and somewhat irregularly punctate; punctures deep, rounded, and crater-shaped; on posterior half punctures are small and much more numerous; derm very nitid; over the whole of the elytra is a sparse

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[1] While this paper was in the press, Mr. G. P. Whitley, Ichthyologist, Australian Museum, kindly drew my attention to the fact that *Strongylurus* Hope, 1834, was preoccupied by *Strongylura* v. Hasselt, 1823, for a genus of fishes (*fide* Sherborn, Index Animalium). The name *Coptopterus* Hope, 1834, must now be used for this genus.

clothing of semi-recumbent hairs, each arising from a puncture. *Legs*: femora clavate, thickly clothed with coarse stamineous hair, derm on outer surface brown, on inner clouded with black, apices black; tibiae and tarsi light brown, clothed with yellowish hair; claws black. *Under-surface* light brown; prosternum densely clothed with close creamy pile; meso- and metasternum nitid; abdominal segments lightly clothed with hair, tending to become condensed into small, rounded, lateral, pilose spots.

Long. 24 mm., lat. 6 mm. A smaller example, long. 19 mm., lat. 5 mm.

Loc.—Queensland: Imbil (A. R. Brimblecombe), 26 October 1937.

Host Plant.—Hoop Pine (*Araucaria Cunninghami*).

Holotype in Queensland Museum, Brisbane.

One of the most striking and distinctive members of the genus *Coptopterus*, both on account of the intricate and strongly marked black pattern on the elytra and its highly nitid appearance. On the apical fourth the specimens have the appearance of having been dorsally compressed, and this area is even more strongly nitid than the rest of the elytral surface; these areas have given one the impression of having been artificially produced, but all the specimens are identical in this respect, so it is evidently a natural character.

Coptopterus musgravei, sp. nov.

♀. Slender; dark stramineous with irregular black bands on the elytra. *Head* narrow, but wider than thorax at anterior margin (as wide as prothorax at greatest breadth); coarsely punctate, with a small but prominent nitid, black tubercle at clypeal angles above insertion of mandibles; clothed with coarse, recumbent grey hair; antennary tubercles prominent, nitid, punctate. *Antennae* as long as, or a little longer than, body; basal joint dark castaneous, nitid, punctate, clothed with short grey hairs; remainder of antenna clothed with short dense pile; joint 3 shorter than 4; 4–6 equal in length, shorter than 7; 7–10 approximately equal; apical joint long, slender, cylindrical. *Thorax* slender in appearance, as long as at widest part; constricted anteriorly and posteriorly, sides gently and evenly rounded; derm coarsely but not deeply punctate, reddish, densely clothed with recumbent grey hairs, no pilose spots; anterior and posterior margins straight, emarginate. *Scutellum* narrow, triangular, clothed with dense white pubescence. *Elytra* little wider than thorax at base, parallel, rounding slightly to external apical angle; apices truncate, acutely bispinose, spines of equal length; dull yellow-brown with a zig-zag transverse black marking commencing behind shoulder and extending almost to suture; a further somewhat W-shaped transverse black marking a little past half-way, and an irregular brown marking on apex; basal half of elytra regularly and coarsely punctate, punctures large; apical area with small sparse punctures; lightly clothed with recumbent white hairs seated in punctures. *Legs* reddish-castaneous with white hairs; tibiae and tarsi with denser clothing. *Lower surface* clothed with recumbent white hairs; sterna somewhat sparsely, abdomen so densely covered that little of the underlying derm is visible.

Long. 25 mm., lat. 5 mm.

Loc.—New South Wales: Port Hacking (A. Musgrave), January 1913.

Holotype in Australian Museum, Sydney.

Comes near *C. lumholtzi* Auriv., but is very readily distinguished by the bispinose elytral apices, the absence of pilose white spots on the prothorax, the sparse elytral clothing, and the dense hairiness of the abdominal segments.

Named for Mr. A. Musgrave, Australian Museum, Sydney.

Coptopterus octomaculatus, sp. nov.

Robust; light ferruginous with black elytral markings; prothorax ornamented with eight white spots. *Head* narrow, produced into a distinct muzzle; clothed with sparse yellow hairs; vertex coarsely punctate, with a median line of dense white pubescence; antennary tubercles medium, rounded; palpi black. *Antennae* as long as body, ferruginous; joints 1–3 semi-nitid, punctate, with scattered hairs; 4–10 slightly produced externally at apex; pubescent on 4–6 with scattered hairs among pubescence, particularly at apices of joints and along inner margin; terminal joint slender, pubescent. *Thorax* coarsely rugoso-punctate with scattered hairs; longer than wide; apex not wider than head, narrower than base; rounded on anterior angles, sides straight, slightly divergent to base; apical margin straight, posterior sinuate, both lightly emarginate; disc ornamented with eight spots of white pubescence, three lateral on each side and two median; lateral spots roughly circular, decreasing in size from base to apex; median triangular; at anterior margin small, irregular. *Scutellum* as broad as long, rounded apically, densely clothed with white pubescence. *Elytra* broader than thorax at base, parallel, slightly rounding to external angles; apices sharply divergent, truncate, acutely bispinose, both spines of equal length and directed outwards; a broken black stripe extending diagonally inwards from shoulder to, but not quite reaching, suture at about one-third elytral length; an irregular (somewhat Λ-shaped) transverse black band at about two-thirds; surface anterior to this deeply and regularly punctate; apical third almost impunctate; the whole surface of elytra evenly and lightly clothed with recumbent white hairs, those on anterior two-thirds seated in punctures. *Legs* reddish, clouded with black, densely clothed with pale hairs. *Under-surface* dark piceus-brown, clothed with sparse hairs; a small white pubescent lateral spot on each abdominal segment, and a similar spot at each extremity of pleura.

Long. 20 mm., lat. 5 mm.

Loc.—S. Queensland: National Park, McPherson Range (A. Musgrave), 18 December 1926.

Holotype in Australian Museum, Sydney.

This insect bears a remarkably close superficial resemblance to *C. cretifer* Hope, but may be readily separated by the divergent and bispinose elytral apices, the single row of white lateral abdominal pilose spots, as compared with the multiple row in *cretifer*, and the eight white pilose spots on the prothorax.

Coptopterus partitus, sp. nov.

♂. Robust; brown and pale fawn marked with black. *Head* relatively narrow, basally constricted, sparsely clothed with adpressed whitish hairs; antennal tubercles slightly elevated, nitid. *Antennae* longer than body, dull ferruginous, pubescent, except basal joint, which is bright ferruginous-yellow; joints 1 and 2 with scattered hairs; 3–11 flattened; 3–10 apically acutely angulate externally; terminal joint with a median longitudinal ridge or keel. *Thorax* strongly rugose, dark piceus-brown, constricted anteriorly, much narrower than at base, slightly and evenly rounded at sides; posterior margin lightly sinuate, narrowly edged with creamy-yellow pile; disc ornamented with two narrow, anterior, longitudinal, dorso-lateral stripes of pale creamy-yellow pile and three similar short basal stripes, of which the median is shorter and broader than the others. *Scutellum* narrow, triangular, densely pilose. *Elytra* wider than thorax at base, parallel; apices abruptly rounding to exterior angle, squarely truncate, acutely bispinose, external spine somewhat longer and stouter than sutural; basal portion of elytra light sepia-brown, shading to pale fawn over apical third; marked with a narrow, curved black stripe extending from just inside shoulder diagonally to, but not quite reaching, suture; a small black patch or spot about apical third; anterior two-thirds deeply and irregularly punctate; area between black patch and apex nitid, almost impunctate; entire surface very sparsely clothed with short hairs. *Legs* almost black, with sparse white hairs thickest on tibiae; femora highly nitid. *Under-surface* piceus, sparsely clothed with short white hairs; a small circular spot of white pile situated laterally on each abdominal segment; sterna rugose.

Long. 20 mm., lat. 6 mm.

Loc.—Torres Strait: Moa, Banks Is. (W. McLennan), 17 December 1919, 20 December 1920; N. Queensland: Endeavour River (South Australian Museum).

Holotype in Australian Museum, Sydney.

A very distinct species readily distinguished from other described forms by the deeply punctate anterior portion of the elytra, the almost impunctate and quite strongly nitid apical portion, the strongly bispinose elytral apices, together with the coloration and sparse black markings.

In a note supplied by Mr. McLennan, he states that the specimens were 'caught on cut trees of Moreton Bay Ash [? *Eucalyptus tesselaris*] and *Alpenia* at night'. These trees may prove to be host plants.

Coptopterus scriptelytron, sp. nov.

♂. Robust; ferruginous with irregular black elytral markings. *Head* broad; area adjacent to antennary tubercles densely clothed with bright yellow pubescence; vertex very sparsely punctate, subnitid, with sparse hairs; base somewhat tumescent, coarsely punctate; antennary tubercles rounded, prominent; eyes coarsely granulate, approximate above, strongly lunulate. *Antennae* longer than body, apex of 9th joint reaching to extremity of elytra, ferruginous; basal joint strongly curved, nitid, sparsely punctate, with scattered hairs; joint 2 nitid; 3–10 broad, flattened, and expanded into a strong external angle, finely and closely pubescent; apical joint elongate, foliate, pubescent. *Thorax* black, much broader than long, straight on anterior and posterior margins, very slightly and regularly rounded on sides; disc dorsally depressed, very coarsely and confluently punctate, marked at base with three small patches of yellow pubescence, the median triangular, lateral linear. *Scutellum* curvilinear-triangular, clothed with dense yellow pubescence. *Elytra* little wider than prothorax, parallel, apices slightly rounded externally, obliquely truncate with a short, stout sutural spine; each elytron with a curved black linear marking from shoulder towards, but not contiguous with, suture, and extending for about one-third elytral length; area between the termination of this marking and base deeper and richer in colour than general tone of elytra; commencing about half-way a brown C-shaped marking (reversed on right elytron) curving around apex; base of elytra deeply and coarsely punctate, apical half finely and sparsely clothed with scattered white hairs, densest at apices. *Legs* dark ferruginous, sparsely clothed with short white hairs. *Under-surface* deep chocolate-brown with sparse hairs on sterna; abdomen more densely clothed, with a small lateral spot of white pubescence on each segment.

Long. 17 mm., lat. 4 mm.

Loc.—New South Wales: Dorrigo (W. Heron); N. Queensland: Cairns district (F. P. Dodd); Torres Strait: Moa, Banks Is. (W. McLennan), 16 January 1920. Holotype (Dorrigo) in Australian Museum, Sydney.

This is a very striking little species, readily distinguished by its exceptionally broad and coarsely punctate thorax, small size, and distinct colour pattern. In the specimens from Moa, Banks Is., the colour is rather lighter than in the type, the C-shaped brown apical mark is broken on lateral margin near apex, separating it into two distinct markings, it does not extend so far onto suture. The Cairns district material conforms closely to type.

I am not altogether satisfied that this species is correctly included in *Coptopterus*, but there appear to be no essential features, apart from its broader and more rugose prothorax, upon which it could be separated. It appears to be allied to *Lygesis ornata* Blackburn, which, in its turn, bears little resemblance to the other members of that genus, and seems closer to *Strongylurus*. Blackburn, when describing *ornata*, appeared to be in considerable doubt as to its ocrrect position. He had, at that time at least, apparently not seen a specimen of a *Lygesis*. It is possible that it will prove necessary either to erect a new genus to include these species, or, pending a more satisfactory arrangement, transfer *ornata* to *Coptopterus*.

Coptopterus stramineous, sp. nov.

(Pl. xxxi, fig. 3.)

? ♀. Robust; pale stramineous-yellow with sparse black elytral markings. *Head* relatively broad, punctate, densely clothed with yellow hair; antennary tubercles not prominent, punctate. *Antennae* not reaching apex of elytra (about three-quarters); basal joint stout, tumid on external angle; joints 1–6 densely clothed with yellowish hair overlying a coarse pile; remaining joints densely pilose; 4–9 angulate but little produced at apices; apical joint slender, elongate-spatulate. *Thorax* dark reddish-brown, nitid, lightly rugose; broad, as long as wide at apex, much wider at base than apex; broadly rounded on anterior angles, sides almost straight; posterior and anterior margins straight; disc with a central nitid tubercle from which the clothing of recumbent hairs extends rather spirally. *Scutellum* broadly scutate, with sparse, short, brownish pile. *Elytra* much wider than prothorax at base, parallel, rounding broadly to apex over apical fourth; apices truncate, unarmed; each elytron with angle of shoulder black; a small central black spot at one-third, and an irregularly transverse wavy black mark at about two-thirds elytral length, not contiguous with suture or lateral margin; coarsely and regularly punctate at base, punctures progressively decreasing in size to apex. *Legs* dark umber with cream hairs. *Under-surface* clothed with whitish hairs, prosternum most densely; abdominal segments and pleura with close, fine, white pubescence.

Long. 20 mm., lat. 6 mm.

Loc.—North Australia: Adelaide River (H. W. Brown).

Holotype in Australian Museum, Sydney.

With the exception of *decoratus*, this is possibly the most distinct of the species of *Coptopterus*, and bears little resemblance to any of the described forms. It is nearest, perhaps, to *thoracicus* Pasc., but lacks the sutural spine on the elytral apices, the pubescent patches on the prothorax, as well as in the sparseness of the black elytral pattern. In some specimens of *stramineous* the black spot at one-third elytral length is extremely minute and may possibly become obsolete in some specimens.

Genus **Phantissus**, nov.

Robust; elongate. *Head* large, somewhat transverse; eyes medium, coarsely granulate, irregularly lunulate, lower lobe much expanded; palpi short, terminal joint broadly spatulate; antennary tubercles depressed, laterally deflected. *Antennae* very short; basal joint elongate-clavate, strongly curved; 3rd joint much longer than 4; 4 and 5 equal, shorter than 4; 8 and 9 equal, shorter than 6; 10 shorter than 8; 11 longer than 10, elongate, tapering. *Thorax* cylindrical, much longer than broad. *Scutellum* broader than long, triangular. *Elytra* parallel, wider than prothorax at base. *Legs*: femora, front clavate, middle slightly swollen, hind slender; tibiae shorter than femora; tarsi almost as long as tibiae; hind femora and tibiae together not reaching apices of elytra.

The genus comes near *Coptopterus*.

Genotype the following species.

Phantissus citatus, sp. nov.

(Pl. xxxii, fig. 2.)

Robust, but elongate (five times as long as broad); brown. *Head* large, somewhat transverse, with a short muzzle; densely clothed with coarse recumbent buff hair; a wide median sulcus extending from base to clypeal suture; antennary tubercles depressed, laterally deflected; mandibles black, coarsely punctate over basal half; eyes medium, coarsely granulate, irregularly lunulate, lower lobe considerably expanded; palpi short, terminal joint broadly spatulate. *Antennae* very much shorter than body, reaching to barely half length of elytra; basal joint elongate-clavate, strongly curved; 3rd joint considerably longer than 4; 4 and 5 equal; 6 and 7 equal, shorter than 4; 8 and 9 equal but shorter than 6; 10 shorter than 8; 11 longer than 10, elongate, tapering. *Thorax* cylindrical, one-third longer than broad, somewhat constricted anteriorly; sides almost straight; disc strongly convex, densely clothed with long recumbent, buff hair; a central nitid area (probably abraded), the naked derm coarsely and sparsely punctate. *Scutellum* broadly triangular, lightly pilose. *Elytra* parallel, little wider than prothorax at base, finely rugose, with tangled and adpressed hairs seated in punctures; apices acutely bispinose; basal third of elytra of a darker shade than remainder; faint indications of a narrow diagonal dark fascia crossing each elytron at about half-way; clothed with sparse recumbent hair. *Legs* densely clothed with long greyish hairs; femora, front clavate, middle slightly swollen, hind slender; tibiae on all legs shorter than femora; hind femora and tibiae together not reaching beyond apices of elytra. *Under-surface* densely clothed with long, coarse, recumbent, grey hairs.

Long. 25 mm., lat. 5 mm.

Loc.—New South Wales: Newcastle.

Holotype in Australian Museum, Sydney.

This truly remarkable longicorn bears some resemblance to certain members of the genus *Coptopterus*, but presents so many divergent features that its inclusion in that genus is untenable. It is very readily identified by its exceptionally short antennae and short legs, while the proportionate length of the antennary joints is quite unlike that of any Cerambycid known to me. The short legs and elongate body give the insect a very curious appearance. I believe that I have both sexes before me, the assumed male being described above; the (assumed) female is similar, but with antennae reaching little beyond basal third of elytra.

Genus **Tya**, nov.

Insects of medium size; slender. *Head* relatively broad; eyes coarsely granulate, broadly lunulate; antennary tubercles mediocre. *Antennae* with basal joint clavate; joint 3 longer than 4; 5–11 equal, longer than 3, slender, cylindrical. *Thorax* cylindrical; longer than broad. *Elytra* tapering, dorsally depressed. *Legs*: femora clavate; posterior femora reaching to the extremity of body; tibiae slender, hind tibiae shorter than femora; terminal joint of tarsi expanded.

Comes near *Lygesis*.

Genotype the following species.

Tya stellata, sp. nov.

(Pl. xxxi, fig. 5.)

? ♂. Slender; piceus-brown with white pilose spots. *Head* broad, short, coarsely punctate; eyes large, prominent, coarsely granulate, broadly lunulate; area between eyes wide, clothed with sparse hairs; antennary tubercles mediocre, little elevated; jaws strongly arcuate, brown, smooth, impunctate; palpi ferruginous, apical joint clavate. Antennae slender, ferruginous, longer than body, apex of 8th joint reaching end of body; proportions of antennary joints as in generic diagnosis; sparsely pilose; joints 3–6 lightly fringed beneath with hair; 3–5 with an erect apical hair or bristle. *Thorax* cylindrical, much longer than wide, slightly depressed dorsally on disc, constricted anteriorly and posteriorly, sides gradually and evenly rounded; anterior margin much narrower than head; margins straight, posterior lightly emarginate; disc rugose with small, irregular nitid areas near centre, ornamented laterally with three longitudinally placed pilose cream spots, the anterior large, oval, the second small, linear, the third medium, triangular with its base on margin. *Scutellum* as broad as long, triangular, densely clothed with white pile. *Elytra* narrow, wider than thorax (= thoracic length), tapering to apices, dorsally depressed, nitid; basal half coarsely and regularly punctate, punctures smaller and less regular over apical half; apices narrowly rounded; suture lightly emarginate; each elytron with four pilose white spots, the first about one-third of elytral length from base, placed somewhat laterally, large, circular, the second almost immediately behind it, medium, transverse, more centrally placed, the third a transverse band one-sixth from apex extending across elytron, but not contiguous with suture or lateral margin; there is an indication of an indistinct fourth spot immediately behind the second and on lateral margin; sides of elytra and towards apices lightly clothed with sparse white hairs. Legs ferruginous, sparsely clothed with short white hairs; femora clavate, hind femora reaching to extremity of abdomen. *Under-surface* dark ferruginous with sparse white hairs; pleura with two anterior pilose white spots, and a similar but thin covering of pile over posterior half.

Long. 10 mm., lat. 2 mm.

Loc.—New South Wales: Broken Hill (F. W. Shepherd), 1924.

Holotype (unique) in Australian Museum, Sydney.

This beautiful and strikingly marked little longicorn appears to come near *Lygesis*, but, since I cannot reconcile its characters with those of members of that genus, it has appeared desirable to erect a new one for its reception.

Genus Uracanthus Hope, 1833.

Uracanthus fuscocinereus White, 1855.

It appears necessary to draw attention here to an error in a paper by the late A. M. Lea[1] which, if allowed to remain uncorrected, is liable to lead to confusion among workers on the Australian Cerambycidae who accept the statement at its face value. In discussing *Uracanthus dubius* (p. 372) Lea states: 'One of the specimens was labelled *fuscocinereus* in the Blackburn Collection, but it is evidently not that species, which is described as being much smaller and as having three smooth brown patches at the base of each elytron: one humeral, one median, and one sutural; markings which, if constant, should readily distinguish it from all others of the genus'. Again, under '*Uracanthus fuscocinereus* White' (p. 383), we find this statement: 'The original description of this species is insufficient for its positive identification, and it was possibly founded on one of the numerous varieties of *triangularis*.'

White's[2] original description, although somewhat brief, is clear and adequate:

'U fusculus; thorace supra nigro-fusco transversim strigato, vittis duabus albis; elytris singulis basi maculis tribus laevibus brunneis, primâ humerali, secundâ medio, tertiâ suturali; elytris basi squamulis griseis, ad mediam partem in fuscas squamas transeuntibus.

'Brown; head behind with two bands of white hairs; thorax above transversely striated, with two pointed tubercles in the middle, deep blackish-brown in the middle and on the sides, and with two bands of white hairs.

'Length 13 to 14 lines.

'Hab. Australia.'

It would appear that, as this is a perfectly good and easily recognizable species, and in fact one of the most distinctive members of the genus, at the time Lea revised the genus *Uracanthus* he was quite unfamiliar with the species in question, and rashly assumed that it was only a variety of *triangularis*, an insect from which it is very distinct. When examining the collection of Cerambycidae in the South Australian Museum in 1936, I found no specimens of the true *fuscocinereus*.

There is a large series of specimens of *Uracanthus fuscocinereus* in the Australian Museum collection, all from New South Wales. The three nitid patches on the base of the elytron are constant in all specimens, and the species is very easily distinguished in this and other respects from its congeners.

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[1] Lea.—Trans. Roy. Soc., S. Australia, xl, 1916.

[2] White.—Cat. Coleoptera Brit. Mus. (N.H.), viii, 1853, p. 330.

Genus **Stenoderus** Serville, 1825.

Stenoderus suturalis (Olivier), 1825.

1795. *Cerambyx suturalis* Olivier, Ent., p. 29, t. 3, f. 29. New Holland.
1801. *Cerambyx abbreviatus* Fabricius, Syst. El., ii, p. 275. Nova Cambria.
1818. *Leptura ceramboides* Kirby, Trans. Linn. Soc. Lond., xii, p. 472, t. 23, f. 11 (col.). New Holland.
1835. *Stenoderus dorsalis* Boisduval, Voy. Astrolabe, Ins., ii, p. 521. New Holland.
1859. *Stenoderus labiatus* Pascoe, Trans. Ent. Soc. Lond. (2) v, p. 24. Australia.

With an extremely variable species it is almost inevitable that synonyms must arise. *Stenoderus suturalis* has proved no exception, as is evidenced by the synonymy given above. Aurivillius[3] treats *abbreviatus*, *ceramboides*, *dorsalis* and *labiatus* as varieties of *suturalis*.

An examination of a very large series of specimens of this insect in the Australian and Macleay Museums, collected from all parts of Australia, together with field studies in New South Wales, has convinced me that the retention of these names as varieties is untenable, since such a practice serves no useful purpose. Variations from the normal form of *suturalis* may be collected in one district, each of which will closely fit the descriptions of the different varieties; each of these is linked with the others by such fine gradations that it is impossible to separate them. It appears to me, therefore, that all the varietal names, as retained by Aurivillius, should be treated as absolute synonyms of *suturalis*. Where varietal names are used solely for definite geographical races the system is of value, but when, as in the present instance, such distinct races do not exist, no good purpose is served, and the names only confuse the synonymy of the species.

The synonymy of the species will, therefore, stand as above.

Genus **Macrones** Newman, 1841.

Macrones purpureipes Lea, 1908.

By inadvertently overlooking a paper by the late A. M. Lea, I fell into the error of accepting *purpureipes* as a manuscript name, and describing the insect as new. The insect was originally described by Lea[4] in a paper entitled 'The Coleoptera of King Island, Bass Strait', which contains the description of a single Cerambycid (p. 201). This paper was also overlooked by Aurivillius in the Junk Catalogue, and although the title of the paper is listed in the Zoological Record, no reference is given to the species. My notes[5] are therefore only a redescription of Lea's species and the authorship should be credited to him. It is figured in my paper for the first time.

Genus **Somatidia** Thomson, 1864.

Somatidia pernitida, nom. nov.

As *Somatidia nitida* McKeown, 1938, is preoccupied by a species by Broun, the above new name is proposed for this species.

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[3] Aurivillius.—Catalogus Coleopterorum (Junk), pars. 39, 28 February, 1912, p. 151.
[4] Lea.—Proc. Roy. Soc. Victoria (n.s.), xx, 2, 1907 (March, 1908), pp. 143-207.
[5] McKeown.—Rec. Austr. Mus., xx, 3, 31 August, 1938, p. 205.

Genus Temnosternus White, 1855.

Temnosternus imbilensis, sp. nov.

(Pl. xxxii, fig. 1.)

Robust; dark brown varied with lighter pile. *Head* small, with a well-defined, narrow median sulcus extending from base to clypeal suture; densely clothed with grey pubescence, a buff pubescent lateral stripe on apex; punctures on frons showing through pile as small black spots; eyes rather small, not prominent; antennary tubercles narrow, not prominent. *Antennae* slender, longer than body; basal joint stout, swollen; joint 3 shorter than 4, but longer than 5; succeeding joints becoming progressively shorter; apical joint slender, elongate; 3–11 lightly fringed beneath; 4–10 apically ringed with whitish pile. *Thorax* wider than head, much broader than long, widely emarginate posteriorly; irregularly rounded on sides, with a small, acute, lateral spine at centre; disc irregularly and coarsely punctate; punctures round, shallow; a broad, flattened and nitid, longitudinal median area, wider at base than apex; a light clothing of short buff pile tending to form lateral stripes, and a dense anterior patch. *Scutellum* strongly transverse. *Elytra* at base broader than prothorax, tapering to apex; apices diagonally truncate, the external angle tending to form a blunt spine; elytral punctures very irregular, varying in size, densest toward base; a strongly-defined, raised, concolorous costa beginning near, but not actually at, base, sweeping inwards towards suture, then curving outwards slightly and continuing parallel with, but at some distance from, suture, almost to apex; derm bright chocolate-brown ornamented and varied with buff and white pile; beginning behind shoulder and passing diagonally to suture (almost) about anterior fourth, a broad band of pale buff pile bordered posteriorly with white; this marking is actually not continuous, but divided into two parts, since the raised costa referred to above separates off a small apical portion near suture; a similar, small, irregular area of like-coloured pile is situated about apical fourth, not reaching either suture or lateral margin; these areas are bordered by irregular patches of naked, highly nitid derm of a very dark brown or black; the suture about the middle is narrowly edged with white pile; the remainder of elytra irregularly streaked with buff pile; the surface of elytra from base to first pubescent marking minutely tuberculate in area between costa and suture; the remainder coarsely, sparsely and irregularly punctate; on the pubescent areas the punctures show as dark spots. *Legs*: femora broadly clavate, densely clothed with grey pubescence, mottled with small dark spots, probably due to underlying punctures; tibiae slender, brown with a grey pubescence concentrated on apical third, mottled with darker spots; tarsi densely clothed with grey hairs. *Under-surface* densely clothed with buff pubescence sprinkled with minute black spots; a nitid, finely punctate area, bare of pubescence, probably due to abrasion, extends up median line of abdomen.

Long. 8 mm., lat. 4 mm.

Loc.—Queensland: Imbil (A.R.B[rimblecombe]), 26 January 1938.

Host Plant.—*Araucaria Cunninghami* (Hoop Pine).

Holotype in Queensland Museum, Brisbane.

One of the most striking and decorative members of the genus, easily identified by the intricate pattern formed by the white and buff pilose areas, well shown in the accompanying figure.

EXPLANATION OF PLATES.

PLATE XXXI.

Fig. 1.—*Nerida intricata*, sp. n.
Fig. 2.—*Piesarthrius reticulaticollis*, sp. n.
Fig. 3.—*Coptopterus stramineous*, sp. n.
Fig. 4.—*Phacodes mirabilis*, sp. n.
Fig. 5.—*Tya stellata*, sp. n.
Fig. 6.—*Coptopterus decoratus*, sp. n.

PLATE XXXII.

Fig. 1.—*Temnosternus imbilensis*, sp. n.
Fig. 2.—*Phantissus citatus*, sp. n.
Fig. 3.—*Nerida carabiformis*, sp. n.
Fig. 4.—*Piesarthrius gearyi*, sp. n.
Fig. 5.—*Wahn zonulitis*, sp. n.
Fig. 6.—*Piesarthrius rufoflavus*, sp. n.

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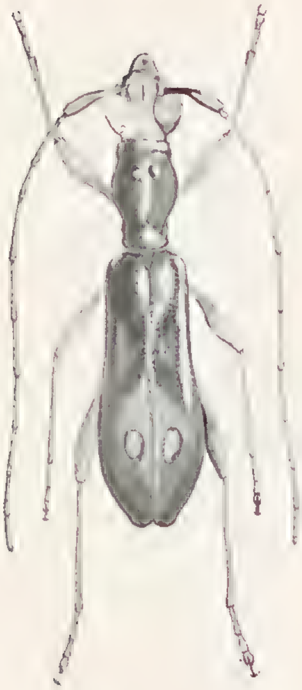

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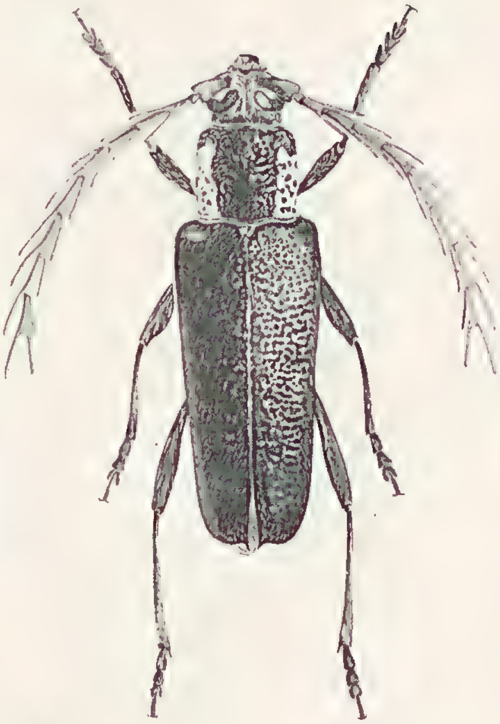

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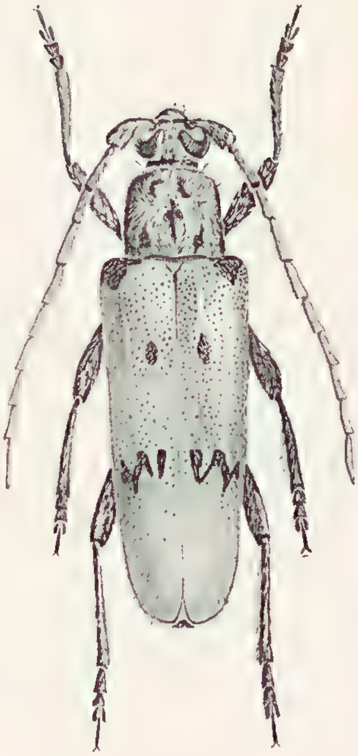

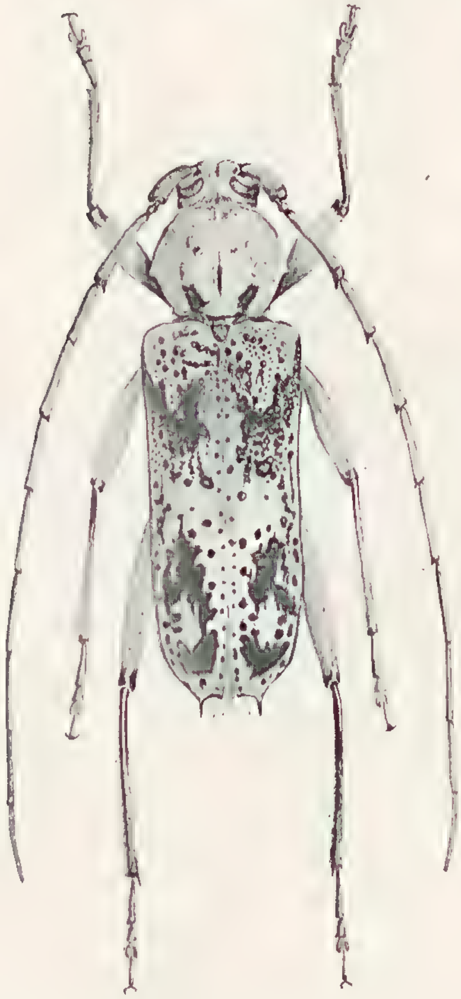

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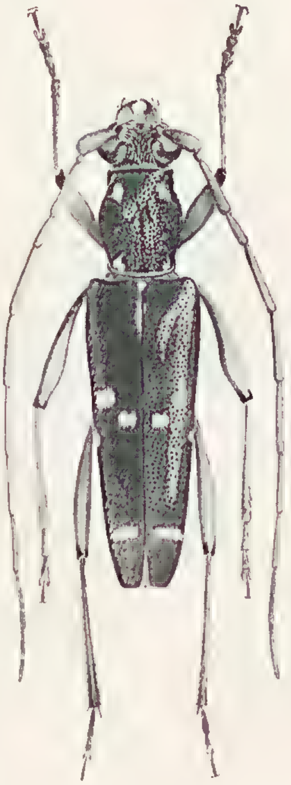

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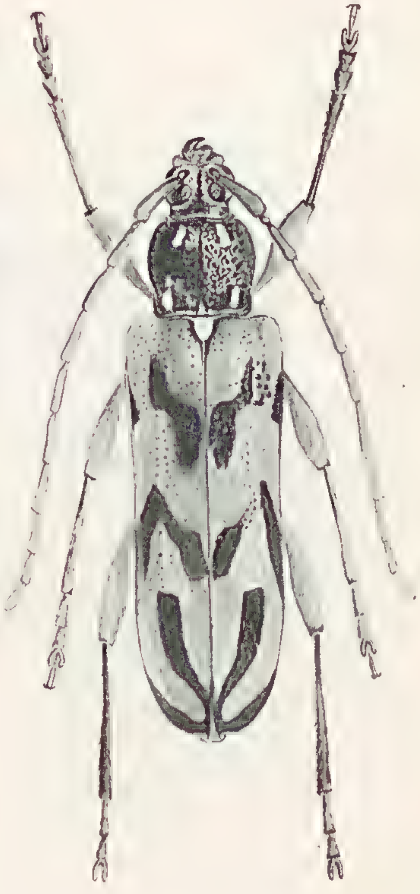

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NANCY B. ADAMS, del.

NATIONAL MUSEUM OF VICTORIA

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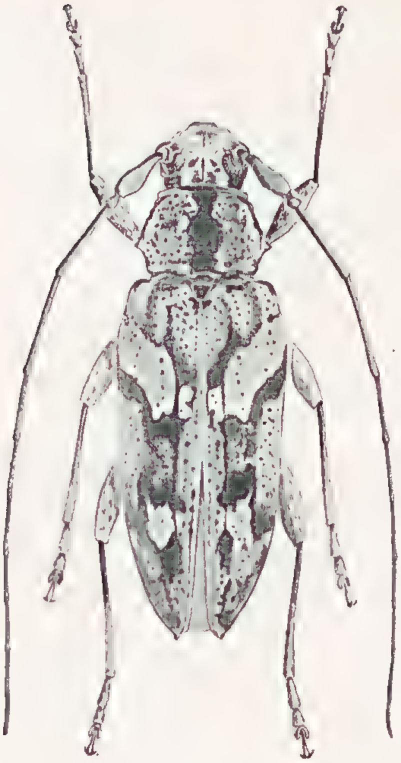

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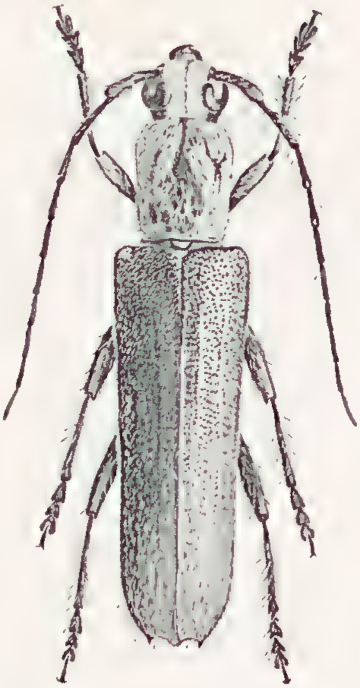

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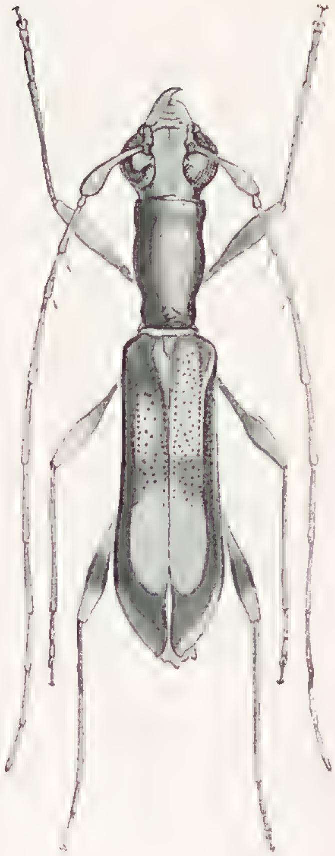

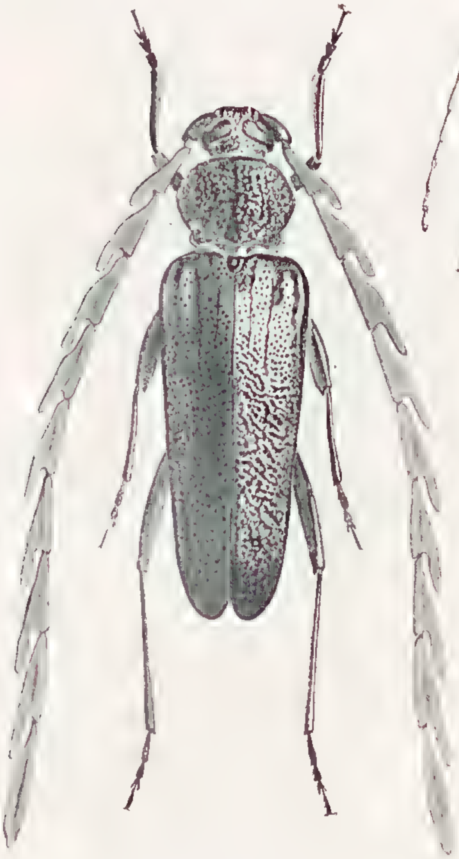

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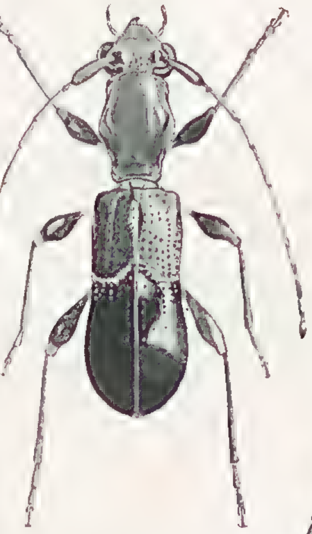

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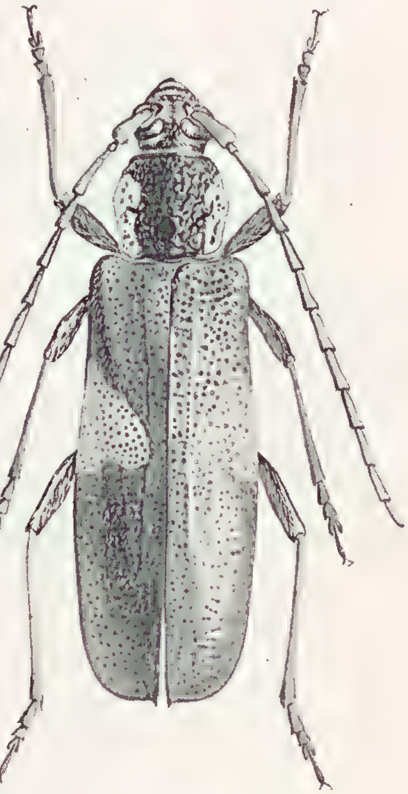

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NANCY B. ADAMS, del.

NATIONAL MUSEUM OF VICTORIA

THE BONE POINT, KNOWN AS *MUDUK*, IN EASTERN AUSTRALIA.

By

Frederick D. McCarthy,
The Australian Museum, Sydney.

(Plate xxxiii and Figures 1–2.)

For some years the *muduk* has been collected on kitchen-middens along the coast of New South Wales and Victoria; examples were found by Harper (1) in a cave deposit which he dug out at Port Hacking in 1899, and the excavation of the Devon Downs cave on the Lower Murray River yielded them in the Mudukian layers especially (2, p. 189–190, figs. 111–7, 153, 155–6, 125–6). A great deal of reliable evidence indicates that the principal use of the *muduk* was as a dual spear point and barb, but it has not been recognized; consequently, on the basis of one record from the Geelong district, Victoria, (12, p. 391), it is generally termed a fish-gorge. In this paper a review of the data is given, together with descriptions of spear prongs bearing *muduk* kindly presented to the Australian Museum by Mr. Ivor Jones, and of other specimens now available.

Records in Literature.

In 1770 Captain Cook (3) observed that some natives he saw at Botany Bay were all armed with "darts", which had four prongs pointed with fish bones and stingray spines; these were used more for striking fish than as offensive weapons. He noted also that these natives formed kitchen-middens, because he saw them gathering oysters, mussels, cockles, etc., on the mud banks, and saw mussels broiling on the fires at their camps.

In 1789 Captain Phillip (4) said that the natives of Botany Bay more frequently point their grass-tree spears with bone than by sharpening the point of the stem. In 1790 White (5) figured a four-pronged fish-spear from the neighbourhood of Port Jackson, and said that each of the prongs is terminated by the tooth of a fish stuck on by a lump of gum cement. In 1793 Captain Hunter (6) described fish-spears in Port Jackson as having 1, 2, 3, or 4 prongs, pointed and barbed with a fish, or animal's, bone, and Captain Tench (7) said they were barbed with the bone of kangaroos.

In 1798 Collins (8) said that the "natives on the sea-coast (from Botany Bay to Broken Bay) procure fish with the fiz-gig, which is made of wattle, and has a joint in it fastened by gum. It is from 15 to 20 feet in length, and armed with four barbed prongs, the barb being a piece of bone fastened by gum."

In 1816 Péron (9) figured a four-pronged fish-spear from Port Jackson. In 1843 Backhouse (10) recorded that he met a party of natives at the foot of Cambewarra Mountains who were carrying multi-pronged spears. In 1845 Hodgkinson (11) figured a native using a three-pronged fish-spear on the Bellingen

River. The point and barb on some of these spears were probably of the *muduk* type.

In 1878 Brough Smyth (12, p. 306) recorded "two forms of spear. In fig. 77 the head and barb are formed wholly of bone, which is firmly attached to the shaft of wood by sinews and gum. In Fig. 78 the head and shaft are of wood, and the barb is a piece of bone, which is fixed by sinews and gum to the side. These are used principally for spearing fish. Dr. Gummow, of Swan Hill, states that these are used also in war. The spike of bone is called *Kulkie*, the barb *Tilloo*."

Brough Smyth (12, p. 391) also stated that: "Mr. A. J. Panton says that the natives of the Geelong district used in former times, for catching bream, a piece of hardwood or bone sharpened at both ends and attached to the line by a hitch-knot (fig. 227). This cannot be called a hook. It was baited, however, and when seized by the fish and the line strained, the bone stuck in the jaws."

In 1879 the Rev. G. Taplin (13) said that the Narrinyeri of the Lower Murray-Coorong area in South Australia catch fish with the three-pronged fishing spear, which is a slender pole about 14 feet long, with three points of sharp bone lashed to its top with twine. Every native carried one in his canoe.

In 1893 Palmer (14) remarks that on the New South Wales coast probably the greatest quantity of fish was obtained by the use of the muttock or three- or four-pointed fish-spear.

In 1893 Mann (15) described the method of making a multi-pronged fish-spear, as follows: A grass-tree shaft was preferred, though the stem of the gigantic lily was used. Two splits were made at one end of the shaft, at right angles, and the pith extracted to the depth of three or four inches. This end is then bound round with ribbon-like strips of bark, obtained from a small shrub or from the kurrajong tree. This aperture was then filled with grass-tree gum, and the four prongs, each slightly tapered at the end, were inserted into it, and the gum which was forced out was spread over the joints. The prongs were from 15 to 18 inches long, scraped to a fine point, and barbed by means of a small splinter of bone fastened to the end. The four points of this spear form a square about one inch or more apart, and are kept in position by small wedges passed between the prongs and fastened by bands of ribbon bark. The pitch from the other end of the spear is extracted to the depth of about an inch, the end is bound with twine, and the whole stopped with the fine scrapings of hardwood, which serves as a pad for the hook of the 'wammerah', or throwing-stick, to press against. Other grass-tree spears are made in a similar manner, but with only one prong."

From 1901 to 1909 Roth described the manufacture and use of multi-pronged fish-spears, with the *muduk* forming point and barb, in Cape York on the Palmer River (16), and at Princess Charlotte Bay (17, sect. 68, figs. 255–6), and the four-pronged type at Princess Charlotte Bay, Cape Bedford, Bloomfield and Middle Palmer Rivers (18, pp. 192–4, pl. lviii, fig. 7). He stated in 1909 (18, p. 194) that on the Pennefather River the type was an introduction of but comparatively recent years. He mentions the use of the *muduk* on harpoons on the Batavia River (17, figs. 238–43, sect. 66), and on fighting spears with single points on the Pennefather River (18, p. 191). These *muduk* vary from 3–30 cm. in length (Pl. xxxiii, fig. 5).

In 1904 Petrie (19) says of the Turrbal tribe of the Brisbane district that "the sharp barb from the butt of a stingaree's tail might be used for the point of a spear. It was fastened on with bees' wax and string."

In 1930 Hale and Tindale (2, p. 205) stated that "the implements recovered seem to indicate that the people of Murundian horizons were the last at Devon Downs (rock-shelter on the Lower Murray River) to extensively utilize bone implements; most of the examples are smaller than those in Pirrian and earlier layers. The *muduk*, or supposed fishing-bone, the most characteristic of these bone artefacts, apparently was not used by Murundian people. . . . In the accompanying drawing (fig. 242) a line is shown attached to one of the *muduk* from Devon Downs in the manner illustrated by Brough Smyth; it is worthy of note that slight grooves are present on the edges of the bone where encircled by the string (compare figs. 111, 153, and 242, all illustrations of the same specimen)." And (2, p. 189) that "double-pointed fusiform artefacts, made from split bone, and scraped and highly polished at both ends . . . are similar to the type said to have been used for fishing [12, p. 391]; as their name is unknown, the Murundian word for bone, '*muduk*', is here adopted for them". Double-pointed *muduk* were found in layers III (Murundian) (2, p. 181, fig. 154), VI (Mudukian) (2, p. 189, figs. 111–17, 153, 155), and VII (Mudukian) (2, p. 190, figs. 125–6, 156).

Descriptions of Specimens.

There are four spears from "New South Wales" in the collection of the National Museum of Victoria, of which Mr. D. A. Casey, Honorary Archaeologist, has kindly supplied me with the following details.

No. 1057 (Plate xxxiii, fig 1): hardwood (reddish-brown), with short reed-shaft or butt, and 2·62 metres long. A bone *muduk* is mounted as dual point and barb; it is bound on with vegetable fibre covered with gum. This binding encircles both the spear and the *muduk*, and towards the barb end is done in a figure-of-eight. Gum is smeared for 46 cm. from the point down the shaft of the spear-head, and there is a concavity on the butt for a spear-thrower peg.

No. 1058 is 2·62 metres long, No. 1725 (Plate xxxiii, fig. 2) is 2·41 metres, and No. 1727 (Plate xxxiii, fig. 3) is 2·39 metres. There is no gum on the heads of Nos. 1058 and 1727.

The *muduk* on these four spears have been ground all over to a smooth surface, are flattened-oval in section, and pointed at each end. The flatter surface on each one is set against the spear-head.

The locality given is New South Wales. They were purchased from H. F. Richardson, and came from the estate of the late A. H. Smith, of Batesford, Victoria, on 7 May, 1888.

In the Australian Museum collection there is a spear (B.8461, Plate xxxiii, fig. 4) made of a reddish-brown hardwood, 1·64 metres long, 2·5 cm. thick, one-piece with acicular ends; a bone *muduk* mounted as a barb projects 5·3 cm. from a binding which is overlaid with gum. The *muduk* is 6 mm. thick, flat on the side facing the spear-shaft, and rounded on the outer surface. Locality: Lower Darling River, N. S. Wales. Collected by K. H. Bennett in 1885.

In 1938 Mr. Ivor Jones kindly presented to the Australian Museum a number of prongs of fish-spears which he had found in a crevice in a cave near Lake Wonboyn, on the south coast of New South Wales. Details of these prongs are as follows:

(*a*) (Plate xxxiii, fig. 10): 9 spatulate prongs, from 9·5 to 31 cm. long (E.43496–502, E.43504).

(*b*) (Plate xxxiii, fig. 9): 2 spatulate prongs, bound together with thin strips of bark up to 7 mm. wide; they are 26 and 27 cm. long (E.43503).

(*c*) (Plate xxxiii, fig. 8): 10 pointed prongs, from 14·5 to 26·5 cm. long (E.43486–95).

(*d*) 3 pointed prongs, each bearing a bone point bound on with vegetable fibre so as to form a point. E.43483 is 24·5 cm. long and has an unworked bone splinter 4 cm. long pointed at the free end; E.43485 is 15 cm. long, and has an unworked bone splinter (the point is missing) 1·5 cm. long; E.43484 (Plate xxxiii, fig. 7) is 26 cm. long, and has a bone splinter 2·5 cm. long which has been ground on both sides at one end to form a point, the other end is blunt and enclosed in the binding.

In 1938 it was ascertained that Mr. J. Ashley, of Rockdale, Sydney, had in his possession the head of a three-pronged fish-spear from Wallaga Lake (Plate xxxiii, fig. 6), on the south coast of New South Wales, and he kindly made it available for description. The prongs are bound on to the short piece of shaft with dark fibre, and this binding is 17·5 cm. long; the prongs project 44 cm. The binding is covered with gum, and its surface is red-ochred. 2·5 cm. above the binding gum has been smeared for 13·5 cm. along the shaft of each prong. A double-pointed bone *muduk* is mounted on each prong; each of these *muduk* is set in gum in a groove cut into the end of the prong, and bound with thin strips of grass, so that it forms a dual point and barb. Two of the *muduk* are 7 cm. long, and one is 7·5 cm. All are 4 mm. wide and from 1·5 to 2 mm. thick.

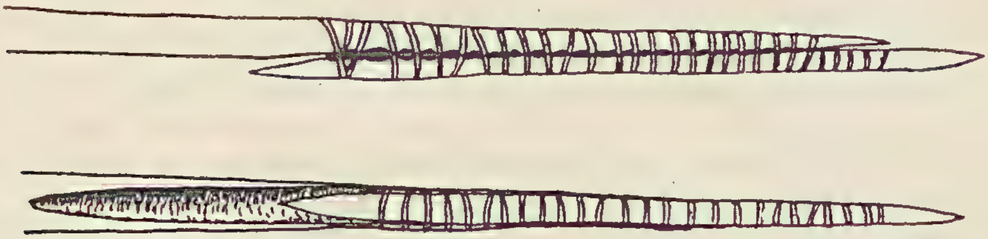

Fig. 1.—Attachment of *muduk* to multi-pronged spear from Wallaga Lake.

The single-pointed spears in the National Museum of Victoria, the Lower Darling River specimen, and the three-pronged spear from Wallaga Lake agree in all respects with those from Cape York described by Roth, and those from the coast of south-east Australia described by early writers.

The *muduk* named by Hale and Tindale is the double-pointed form thought to be a fish-gorge, but the evidence given above proves that it is also a dual spear point and barb. Further, the spear prongs from Lake Wonboyn indicate that the single-pointed bones used as spear-points should also be classified as *muduk*.[1]

The *muduk* found on the kitchen-middens along the coast of south-east Australia include both types, as follows:

(*a*) Pointed by grinding at one end only.

(*b*) (Plate xxxiii, fig. 11.) Double-pointed, ranging from 4 to 8 cm. long, and from 5 to 8 mm. wide. They are oval and flattened-oval in section, usually flat on the inner side (when mounted), convex on the outer side, and shaped (usually on both sides) by grinding so as to produce a fusiform shape. The grinding often extends all round each end contiguous to the points.

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[1] Some of the bone splinters and single-pointed bones found in layers III (Murundian), V-VII (Mudukian), and X (Pirrian) of the Devon Downs deposit (2) were probably spear points.

Discussion.

In his paper on the distribution of spear-traits in Australia, Davidson (20) says that "the Australian use of bone-barbs is concentrated in Queensland and the Cape York peninsula, and probably extends as far south as northern Victoria. . . . Bone-barbs seem to be quite definitely associated with reed-spears in Australia, Torres Strait and parts of New South Wales, and also with reed arrows in Torres Strait and in New Guinea. Since there is a contiguity throughout this distribution an historical relationship seems apparent. All of the reed-spears with bone-barbs seem to be thrown with the aid of a spear-thrower."

In reviewing (21) this paper I put forward the contention that the bone *muduk* found on the coast of south-east Australia were used as spear points and barbs, and that, therefore, it is probably correct to assume that this type of spear was used wherever the *muduk* occur in this region. Dr. Davidson (22), replying to this review, stated that further evidence was required before the double-pointed bones found archaeologically in coastal sites in south-eastern Australia could be accepted as barbs for spears.

Sufficient new evidence about the use of spears bearing *muduk* along the coast from Brisbane to the Murray River mouth is presented in this paper to establish beyond all doubt that the *muduk* collected on the coastal middens were used as spear points and as dual points and barbs on the multi-pronged and single-headed spears. That the *muduk* was also employed as a fish-toggle is probable, although the Geelong district (Victoria) record is the only one.

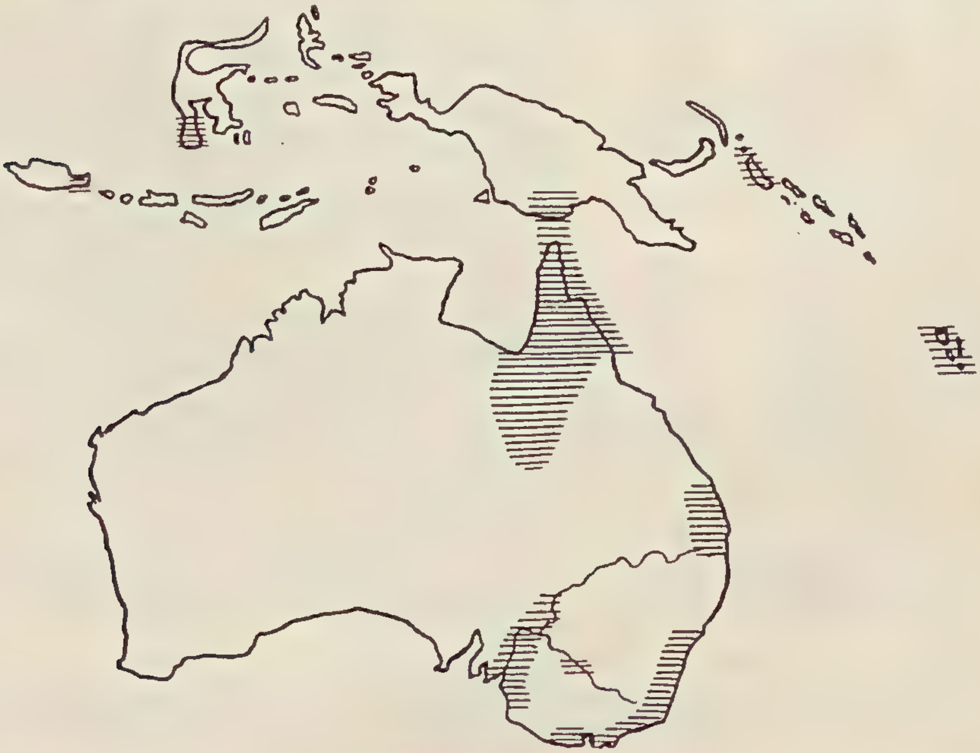

Fig. 2.—Distribution of the *muduk*.

These new records extend the distribution of bone-barbed and pointed spears given by Davidson in his map (22). The known range in south-east Australia is now from the Brisbane District to the Murray River mouth, Lower Darling and Murray Rivers, and at Devon Downs and Swan Hill on the Murray River. They appear to have diffused southward from Cape York along the east coast of Australia, to have spread along the Murray River from its mouth, and also up the Darling River.

Careful collecting will probably yield *muduk* on the kitchen-middens on the north coast of New South Wales, and the Queensland coast between Brisbane and the Tully River, and close the gaps in their distribution. It is to be noted that mammal bones, bird bones, fish teeth and bones, and stringray spines were used for making *muduk*.

Muduk occur on the arrows and spears of Bougainville and Buka, Solomon Islands. On New Hebridean spears polished double-pointed bone barbs are mounted in a reverse manner, and vary from 5 to 20 cm. in length. *Muduk* are present in the prehistoric Toalian culture of Celebes and southern Java.

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(18) Roth, W. E.: *Op. cit.*, *Bull.* 13, 1909. *Rec. Austr. Mus.*, vii, 4, 1909.

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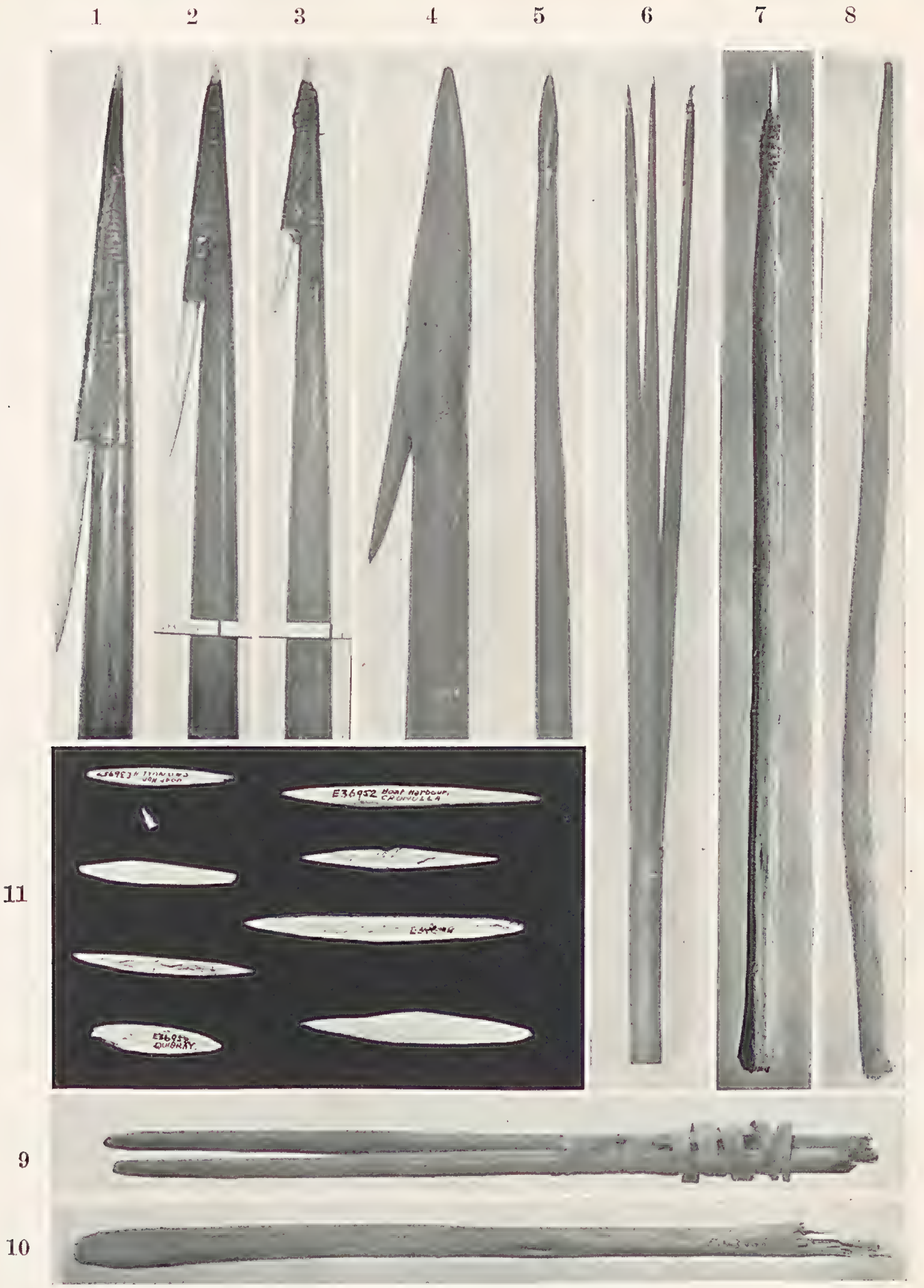

D. A. CASEY (1–3) and G. C. CLUTTON (4–11), photos.

NATIONAL MUSEUM OF VICTORIA

EXPLANATION OF PLATE XXXIII.

Figs. 1-3.—"New South Wales" National Museum of Victoria Collection, Nos. 1057, 1725, 1727.

Fig. 4.—Lower Darling River, N. S. Wales (A.M., No. B.8461).

Fig. 5.—Mapoon, Batavia River, Cape York, Queensland (A.M., No. E.11760).

Fig. 6.—Four-pronged spear, Wallaga Lake, N. S. Wales. J. Ashley collection.

Fig. 7.—Lake Wonboyn, N. S. Wales (A.M., No. E.43484).

Fig. 8.—Pointed spear prong, Lake Wonboyn (A.M., No. E.43504).

Fig. 9.—Pair of spatulate prongs bound with bark. Lake Wonboyn (A.M., No. E.43505).

Fig. 10.—Spatulate spear prong, Lake Wonboyn (A.M., No. E.43498).

Fig. 11.—Series of eight double-pointed *muduk* from kitchen-middens on the south coast of N. S. Wales (A.M. specimens).

A RARE STALK-EYED SQUID (*BATHOTHAUMA LYROMMA* CHUN) NEW TO AUSTRALIAN WATERS.

By

JOYCE ALLAN,
Assistant Conchologist, Australian Museum.

(Figures 1–7.)

A very rare cephalopod has been found recently in Australian waters. It was collected in a surface net of the Fisheries Investigation vessel "Warreen" from St.62/38 (Tasmania), N. 200 horizontal; and, with the permission of Dr. H. Thompson, Officer in Charge, Fisheries Section, Council for Scientific and Industrial Research, I am now able to record it for the first time from Australia. I wish to express my thanks to Dr. Thompson for the opportunity to examine this rare cephalopod.

Only on four previous occasions has this species, *Bathothauma lyromma* Chun, been recorded. The genus *Bathothauma* was created by Chun[1] for a single specimen caught in 3,000 m., west of Cape Verde in the Guinea Stream by the "Valdivia" Expedition in 1903; but only a brief description of the characters is given in a general account of a pelagic family of squids, the Cranchiidae, in which he placed it. Robson,[2] when describing a model of this species in the British Museum, remarked that up till 1930 only two specimens of this very rare cephalopod were known: the "Valdivia" one from the Atlantic, and another obtained by the United States Fisheries Commission steamer "Albatross" in the eastern Pacific.

A third one, however, which Robson does not mention, is recorded by Joubin.[3] This was caught during the 1910 voyage in 3,660 m., at St.3039 (Lat. 36° 05′ 30″ N.; Long. 9° 00′ 30″ W.), and though it was only a juvenile specimen, measuring but 10 mm. from the mouth to the posterior end (Chun's specimen measuring approximately 92 mm.), Joubin had no hesitation in considering it *Bathothauma lyromma*. He states that it does not differ from Chun's figures, and substantiates this by a figure (pl. xiv, fig. 4) of his specimen. Thiele[4] points out that another juvenile species for which Joubin in the same work created a new genus and species, *Fusocranchia alpha*, should belong, in his opinion, to the genus *Bathothauma*; but Joubin's figures of the preserved specimen (pl. xiv, figs. 5–9) do not seem to me to show the characters sufficiently to substantiate Thiele's statement.

The fourth specimen of *Bathothauma lyromma* was collected by Dr. William Beebe at Nonsuch Island, Bermuda. Though an excellent photograph of it appeared in the Bulletin, New York Zoological Society, Vol. xxxiii, No. 2, 1930, p. 76, no facts were given. It appears, then, that only these four specimens were known until the "Warreen" had the good fortune to collect a specimen in Australian waters.

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[1] Chun.—Zool. Anz., xxxi, 1907, p. 86.
[2] Robson.—Nat. Hist. Mag. (B.M.), ii, No. 16, 1930, pp. 257-9.
[3] Joubin.—Res. Camp. Sci. Monaco, liv, 1920, p. 72, pl. xiv, fig. 4.
[4] Thiele.—Handb. der Syst. Weicht., 1931, p. 983.

Though Chun in the original description of his new genus and species gives no figures of his specimen, he provides excellent ones in his "Valdivia" report,[5] and further elaborates the characters of the family Cranchiidae, leaving little doubt as to the identification of the Australian specimen. It should be mentioned here that Chun refers in his text (p. 389) to a photograph of the "Albatross" specimen sent to him by Hoyle, who incidentally had described its eyes and luminous organ,[6] and that this interested him as it showed that the eye-stalks of his (Chun's) specimen were not normal. To illustrate this, Chun figures the ventral surface of the Atlantic *Bathothauma lyromma* with its eye-stalks in their abnormal position (fig. 6), and the dorsal surface of the same specimen with the eye-stalks as shown normal in the photograph of the eastern Pacific "Albatross" one sent to him by Hoyle (fig. 7). Chun's explanation of the latter figure reads: "Fig. 7. Dasselbe Exemplar, Dorsalansicht. Nat. Grösse. Die Augenstiele sind unter Berücksichtigung ihres Verhaltens bei einem zweiten Exemplar gestreckt dargestellt."

In preparing this account of *Bathothauma lyromma*, I have thought it worth while to include copies of the illustrations of Chun's type specimen as well as illustrations of the Australian form.

Class CEPHALOPODA.
Subclass DIBRANCHIA.
Order DECAPODA.
Family CRANCHIIDAE.
Genus **Bathothauma** Chun, 1906.

Bathothauma Chun, Zool. Anz., xxxi, 1907, p. 86.

Haplotype.—Bathothauma lyromma Chun.

Characters of the Genus.—Fins widely spaced. Posterior end of body rounded. Eyes on large plump stalks. Body sac-like. Fins small, rounded, tapering towards the fin attachment. Posterior end of gladius (pen) shaped to a transverse clasp, which gradually expands laterally and with its shovel-shaped ends serves as a support to the fin-attachment. Eyes large, oval, running to a point on the ventral side above the large luminous organ. Eye-stalks long, broad, bent lyre-shaped. Head long and slender. Arms small, tentacles very large; tentacle stalks armed with numerous suckers in two rows along their entire length. Club slightly expanded, very long, keeled. Sac-like end section of the main stomach is turned up ventrally forwards. Pancreas compact, horseshoe-shaped, lying on both sides of the liver, which projects far into the respiratory cavity (Chun).

Bathothauma lyromma Chun.

Bathothauma lyromma Chun, Zool. Anz., xxxi, 1907, p. 86; Wiss. Ergeb. Deutsch Tiefsee-Exped., "Valdivia", xviii, Teil i, 1910, pp. 389–391, Taf. lvi, F. 9, Taf. lvii, F. 1, 2, Taf. lviii, F. 6, 7. *Id.*, Hoyle, 7th Intern. Zool. Cong., Boston, 1907, pp. 831–35 ("advance print" separately paged). *Id.*, Joubin, Res. Camp. Sci. Monaco, liv, 1920, p. 72, pl. xiv, f. 4. *Id.*, Robson, Nat. Hist. Mag. (B.M.), ii, No. 16, 1930, p. 259. *Id.*, Thiele, Handb. der Syst. Weicht., 1931, p. 982, F. 882.

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[5] Chun.—Wiss. Ergeb. Deutsch Tiefsee-Exped., "Valdivia", xviii, Teil i, 1910, pp. 1-400, Taf. lvi, F. 9; Taf. lvii, F. 1,2; Taf. lviii, F. 6, 7.

[6] Hoyle.—7th Intern. Zool. Cong., Boston, 1907, pp. 831-835 ("advance print" separately paged).

Though the Australian form of this species is much smaller than the type specimen and is apparently immature, structurally it is well developed and shows the typical characteristics of the genus and species as described by Chun. Outstanding are the sac-like body with rounded posterior end, conspicuous rounded fins set well apart, large eyes on long plump eye-stalks, long head bearing short sessile, and two very long, non-retractile, tentacular arms, and the very peculiar large hood-shaped siphon.

The "Warreen" specimen shows considerable shrinkage of the tentacular arms, neck portion of the head, and the fins through preservation, but it is easy to see that their proportionate length would be greater when alive. The tentacular arms rise from between the first and second ventral pairs of sessile arms, and, unlike those in many cephalopod groups, are non-retractile. They bear numerous stalked suckers on their club-like extremities, and along the length of the stalks other suckers arranged in two rows on each side, but towards their base in places only a single row on each side. In Chun's description of his specimen we are led to understand, and his illustrations bear this out, that the suckers throughout the length of the tentacular stalks are arranged in one row along each side. In the Australian specimen the suckers are for the main length definitely in two rows with a groove between them, though they change at their base to a single row on each side. The sessile arms are well covered with large suckers, mostly in two rows. The first two dorsal arms are the smallest, the second pair slightly larger, the third pair the largest, and the fourth or ventral pair almost equal them in size. The neck is long and from its base on each side rise the large, plump eye-stalks. These are sufficiently transparent to enable the nerve system to be clearly seen running its course. The eye is elongated and ellipsoid with a long axis, as Hoyle points out (*loc. cit.*), apparently directed vertically in the natural swimming position of the animal. Beneath the eye-ball lies the luminescent organ, occupying a depression close to the apex of the ocular ellipsoid. The eye in the Australian form appears to be exactly as in Chun's figure, which I have included.

The head and body are united in three places, each side of the siphon ventrally and mid-dorsally, and the body bears a very pronounced wide, rolled-back collar, which is entire along the margin except for notches ventrally where it joins the head and in the middle line dorsally. This rolled-back margin seems much wider than that illustrated in Chun's figures of *Bathothauma lyromma*, but otherwise appears the same. Incidentally it is only in this genus of the family Cranchiidae that such a rolled margin exists. The siphon, which is extremely large, is quite unlike the average siphon found in the cephalopoda, and is characteristic of the genus. It has a peculiar hood-like opening suggesting the possibility of control of intake and output, and a base reaching almost to the

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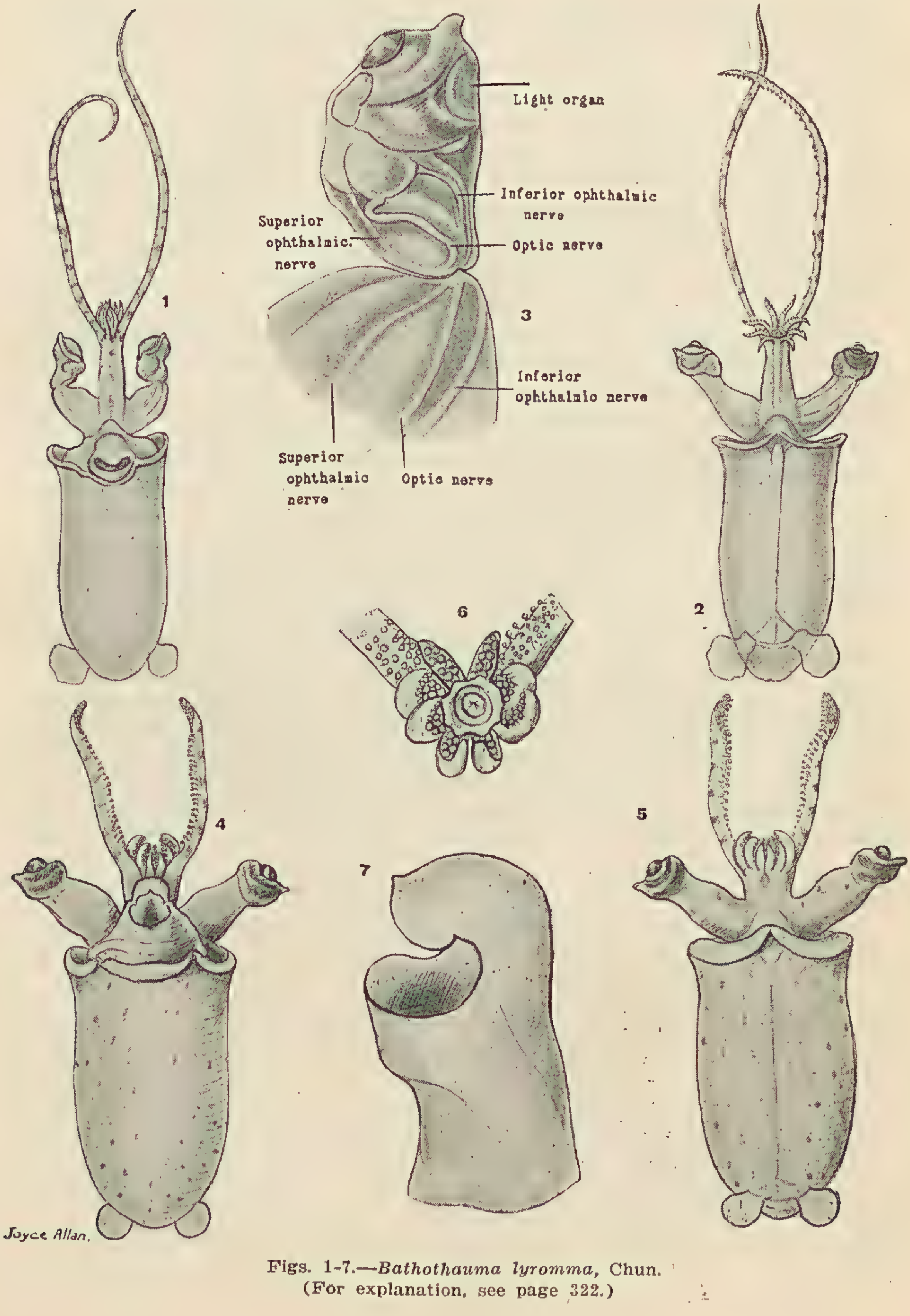
Figs. 1-7.—1. Ventral surface of the "Valdivia", Atlantic type specimen of *Bathothauma lyromma* Chun, showing abnormal eye-stalks (after Chun, Taf. lviii, F. 6). Approximately little less than half natural size. 2. Dorsal surface of same specimen, but with the eye-stalks drawn normally as in the "Albatross", eastern Pacific specimen (after Chun, Taf. lviii, F. 7). Slightly less than half natural size. 3. Side view of the left eye of the type specimen of *Bathothauma lyromma* (after Chun). Enlarged. 4. Ventral surface of the "Warreen" (Australian) specimen of *Bathothauma lyromma*. Enlarged about three times. 5. Dorsal view of same. 6. Relative position of the sessile and tentacular arms to the mouth in the same. Enlarged. 7. Side view of the hood-like siphon in the Australian form of *Bathothauma lyromma*. Enlarged.


1
Light organ
Inferior ophthalmic nerve
Superior ophthalmic nerve
Optic nerve
3
Inferior ophthalmic nerve
Superior ophthalmic nerve
Optic nerve
2
6
4
5
7
Joyce Allan.

Figs. 1-7.—*Bathothauma lyromma*, Chun.
(For explanation, see page 322.)

body sides. The specimen is very delicate, and constant handling was avoided as much as possible, as the skin in the smaller cephalopods at any time is easily rubbed, and the tentacles broken. For that reason I decided not to examine it internally beyond cutting the mid-dorsal line to seek the pen. The body is rounded posteriorly, bearing on the dorsal surface on each side a small rounded, delicate fin. When I first saw a specimen the fins were set wide apart with a fleshy ridge uniting them posteriorly, a similar ridge extending from their outer edges to the medium line, and a formation reaching from the mantle edge to the posterior point of the dorsal surface of the squid, just as figured by Chun. In preservation, however, the fins have come much closer together. On slitting down the dorsal middle line, remnants of a very delicate, horny pen are seen. It is always difficult to prevent these delicate pens from destruction when placing cephalopods in preservative. From the pieces remaining, however, it is seen that the pen extended the full length of the body and was as described by Chun.

The colour of the specimen was pale creamy-white, with rose-red to blackish spots scattered over both dorsal and ventral surfaces, a few on the head and along the eye-stalks. Patches of colour, similar to those on Chun's figure, and, in fact, those on most genera of the family, occur at regular intervals along the tentacular arms; these still show on the specimen in spite of preservation. Round the whole body at regular intervals are wrinkle-like folds from the anterior end of the mantle to the posterior end. Though this may be due to shrinkage in the specimen, yet so regularly do they occur that they may on the other hand be a normal characteristic. Chun makes no mention of such a feature, nor does he show any colour markings on the body of his specimen, only on the arms.

The Australian specimen measures 11 mm. from the collar margin to the posterior end, and is 7 mm. wide; base of neck to mouth, 4 mm.; shortest arm, 1 mm. long; longest sessile arm, 3 mm.; tentacular arms, 7 mm.; eye-stalk to eye, 4 mm. long, 2 mm. wide. The type specimen, which Chun illustrates natural size in the "Valdivia" report, measures, according to that illustration, 92 mm. from mouth to posterior end, with the body 30 mm. wide, and the eye-stalks from base to eye 30 mm. long. It will be interesting to see if the "Warreen" brings to light further and larger specimens of this very interesting species of *Bathothauma*.

THE SECOND OCCURRENCE OF A RARE FISH (*LUVARUS*) IN AUSTRALIA.

By

GILBERT WHITLEY.

Ichthyologist, The Australian Museum.

A very rare and interesting fish was caught at South-west Rocks, northern New South Wales, in June 1939 by Mr. T. Egstein. It came to the Sydney Fish Markets, where it was recognized as *Luvarus imperialis* by Mr. T. C. Roughley, and Mr. George Koutalis purchased the specimen and generously presented it to the Australian Museum. I was away in Western Australia at the time, so regret that I did not see the fresh fish. Mr. H. S. Grant, taxidermist of the Museum, however, obtained particulars of its occurrence and checked its measurements; but the specimen was considered to be too damaged about the body[1] and fins for casting or even preservation, so only the head was kept. The fish was 6 feet 4 inches long, a record size, and weighed 225 lb.; depth about 18 inches. The body was silvery and the tail reddish. Photographs appeared in the papers, and Miss Lily Cook, of South-west Rocks, has sent me a snapshot and some notes, but these do not enable any fin-formulæ or other details to be gleaned. This is only the second time the genus *Luvarus* has come to light in Australia, so that it is a pity that the fish was so damaged; the head is registered Austr.Mus.No.IB.2.

Luvarus imperialis was first described by Rafinesque in 1810 from a Sicilian example. The genus and species has received many names since, because it undergoes a remarkable metamorphosis in its larval and half-grown stages. The fish is now regarded as an extremely modified Scombroid. There is a great deal of literature concerning European specimens and the synonymy is complex. It is difficult to compare Australasian specimens with European ones on account of insufficient material here and the known variability of the latter forms, but if ours be distinct, it will require a new specific name.

The following synonymy of the genus *Luvarus* and list of records from Australia and New Zealand will, it is hoped, assist future students to determine the status of the local form, when further specimens may come to light.

Order PERCOMORPHI.

Series LUVARIFORMES.

Family LUVARIDAE.

Genus **Luvarus** Rafinesque, 1810.

Luvarus Rafinesque, Carat. n. gen. Sicil., 1810, p. 22. Haplotype, *L. imperialis* Raf., figured in Ind. Ittiol. Sicil., 1810, pl. i, fig. 1.

Diana Risso, Hist. Nat. Eur. Mérid., iii, 1826, pp. 106 and 267. Haplotype, *D. semilunata* Risso.

Ausonia Risso, Hist. Nat. Eur. Mérid., iii, 1826, p. 341. Haplotype, *A. cuvieri* Risso.

Astrodermus Cuvier, Règne Anim., ed. 2, ii, April 1829, p. 216, *ex* Bonelli, MS. Haplotype, *A. guttatus* Cuvier, equals *Diana* Risso. Variants: *Astrodermes* Swainson, 1838; *Asterodermus* Agassiz, 1843; *Astroderma* Lowe, Dec. 1843.

Proctostegus Nardo, Diario Chem. et H.N. Ticino, i, 1827, pp. 18 and 42—*fide* Nomencl. Anim., but Sherborn gives: Giorn. di Fisica, (2) x, 1827, p. 27,

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[1] Steaks had been removed for food.

n. nud.; Isis (Oken), 1827, pp. 477 and 484; and De Proctostego, 1827, p. 7. Tautotype, *P. proctostegus* Nardo.

Scrofaria Gistel, Nat. Thierr. höh. Schul., 1848, p. viii. Substitute for *Ausonia* Risso. Haplotype, *A. cuvieri* Risso.

"*Hystricinella*", "*Astrodermella*", and "*Luvarella*" Roule, Ann. Inst. Oceanogr., (n.s.) i, 4, 1924, p. 123. Biological terms (not, in my opinion, generic names) given to stages in the metamorphosis of *Luvarus imperialis* Raf. *Id.*, Roule, Bull. Soc. Zool. France, xlix, 1924, p. 102 (*fide* Zool. Record).

The genus is regarded as containing one species to which many names have been applied under the above genera. *Coryphaena elegans* Risso is another synonym. I have seen Rafinesque's original account in the British Museum (Natural History) library, and a specimen in the Museum at the Naples Aquarium.

It is useful to have terms to indicate larval stages of fishes when these are markedly different from their adults. Thus we refer to the *Leptocephalus* of an eel, the *Tholichthys* of a *Chaetodon* or *Scatophagus*, the *Molacanthus* of sunfishes, and such forms as *Goodella, Atopichthys*, etc. The proposal of new terms when old generic synonyms are available seems, however, uneconomical. Roule's term "*Hystricinella*" for the recently discovered pre-larva of *Luvarus* may be adopted, but, on the grounds of priority, it is suggested that *Diana* would be preferable to *Astrodermella*, and *Ausonia to Luvarella*, for the larval and post-larval ("hémi-larve") stages respectively.

Australasian Records of Luvarus.

Luvarus imperialis was first discovered in Australia by Waite, who published an account of its skeleton in the "Records of the Australian Museum" some 37 years ago. We now have four Australasian records:

(1) Bermagui, southern New South Wales; cast ashore 500 yards up river, August 1901 (Waite, Records of the Australian Museum, Vol. iv, Aug. 1902, p. 292, pls. xlv–xlvi and fig. 22).

(2) Cast on beach near North Cape, North Island of New Zealand, in 1887 (drawing reproduced by Waite, Records of the Canterbury Museum, Vol. ii, No. 1, Dec. 23, 1913, p. 20, pl. vi).

(3) Motutara, near Auckland, North Island of New Zealand, Dec. 1921 (Griffin, New Zealand Journal of Science and Technology, Vol. iv, No. 6, 1922, p. 318, and Annual Report of Auckland Museum, 1921–2 (1922), p. 23).

(4) South-west Rocks, Trial Bay, northern New South Wales, June 1939.

Evidently *Luvarus* is pelagic, probably drifting in the open sea far from land, and rarely becoming washed ashore when senile or diseased. All the Australasian records are from between 30° and 37° S. Lat., on the fringes of the east Australian current in the Tasman Sea.

Luvarus has been recorded from Norway (evidently carried there on the Gulf Stream), S.W. England, Eire (Cork, Donegal), Guernsey, France, Spain, Mediterranean Sea, Madeira, Tunis, Mozambique, California, New South Wales, and the North Island of New Zealand. Since the typical *L. imperialis* breeds in the Mediterranean, it seems likely that the Pacific form may be at least racially distinct.

The vernacular name Luvaru has been used for this fish by some authors, but "Silver King", invented by the Californians, seems to me preferable to the sobriquet "Loo" suggested by the Sydney newspapers.

SYDNEY UNIVERSITY PLANKTON INVESTIGATIONS,
under the Direction of Professor W. J. Dakin, D.Sc.

REPORT ON A SMALL COLLECTION OF MYSIDACEA FROM THE COASTAL WATERS OF NEW SOUTH WALES.

By

WALTER M. TATTERSALL, D.Sc.,
Professor of Zoology, University College, Cardiff, Wales.

(Figures 1–6.)

I am indebted to Professor W. J. Dakin for the opportunity of examining this small collection of Australian Mysidacea. It proved of considerable interest since in it are included three species new to science and a further two species new to the Australian fauna.

The species new to science are *Siriella longidactyla*, *Gastrosaccus dakini* and *Afromysis australiensis*. The species now added to the Australian fauna are *Anchialina penicillata* Zimmer and *Gastrosaccus indicus* Hansen, while the remaining two species, *Siriella australis* Tattersall and *Rhopalophthalmus egregius* Hansen, have already been recorded from Australian waters. The number of species of Mysidacea now known from the coasts of Australia is thirty-eight, and the papers of Tattersall (1927, 1928 and 1936) will provide a full guide to these species.

The shallow water planktonic Mysid fauna of Australia, as evinced by the known species, is distinctly Indo-Pacific in facies, and it is clear that the shallow water fauna of the Indo-Pacific region extends at least as far south as the coasts of New South Wales. Sixteen of the thirty-eight Australian species were recorded by the "Siboga" from the waters of the Dutch East Indies. The species peculiar to Australia are either shallow water non-planktonic species or deep water forms, and it is evident that a great number of species in both these categories still await discovery in Australia.

MYSIDACEA.

Suborder MYSIDA.

Family MYSIDAE.

Subfamily SIRIELLINAE.

Genus **Siriella** Dana.

Siriella australis Tattersall.

S. australis Tattersall, 1927, p. 242.

S. australis Hale, 1927, p. 321.

Occurrence.—Port Stephens, June 1938, over one hundred adult males and females, 8–10 mm., females carrying eggs and embryos.

Remarks.—These specimens agree closely with those described by me from the Gulf of St. Vincent. The number of spines on the lateral margins of the telson varies somewhat in individuals of the same size and also with age. In some of the specimens in this collection there are twenty spines on each lateral margin, two large ones at the proximal end followed by a short unarmed portion of the margin, and then a graded series of eighteen spines gradually increasing in length to the spines at the apex. The "prominent spine" which I described as present on the inner margin of the dactylus of the endopods of the third to the eighth thoracic limbs should more properly be called a spiniform seta.

Distribution.—The type specimens were collected in the Gulf of St. Vincent, S. Australia. I have also recorded specimens which I believed to be this species from the north coast of Kangaroo Island, S. Australia, and from Port Hacking, New South Wales. In the light of the present material I think that my identification of these specimens was correct. It would appear that this species is common off the south-eastern shores of Australia.

Siriella longidactyla, n. sp.

(Figs. 1*a*–1*d*.)

Occurrence.—Port Stephens, June 1938, three adult males and one adult female carrying embryos, 9 mm.

Description.—Carapace produced in front into a short rostral plate, triangular in shape, apex not very acute, apical angle at least a right angle.

Eyes moderate in size, pigment black.

Antennal scale (Fig. 1*a*) not reaching forward to the distal end of the antennular peduncle and slightly longer than its own peduncle; three and a half times as long as broad; without a distal joint; terminal lobe not quite as long as broad and extending some way beyond the terminal outer spine; second joint of the antennal peduncle four times as long as the third.

Endopods of the third to the eighth thoracic limbs (Fig. 1*d*) rather long and slender; sixth joint (protopodite) divided by a suture into two parts, the distal of which is the longer; dactylus exceedingly long, longer than the distal portion of the protopodite; copulatory organ of the male acutely pointed.

Pseudobranchial rami of the second to the fourth pleopods of the male spirally twisted; pleopods of the male without any modified setae at the apex of the rami, but the setae arming the branches appear to be more densely feathered than is normally the case.

Telson (Fig. 1*c*) three times as long as broad and of the usual elongated triangular shape; lateral margins armed with a series of twenty-eight spines, two long ones near the proximal end, then a short unarmed portion of the margin followed by the remaining spines, which are more or less equal to begin with, but with a tendency to be arranged in groups of larger and smaller spines towards the apex; terminal spines the longest and equal to one-tenth of the length of the telson; between the apical spines there are three subequal spinules and a pair of plumose setae; some of the distal spines distinctly barbed.

Inner uropod (Fig. 1*b*) longer than the telson, with a row of about fifty-five spines on the inner margin, commencing some distance behind the statocyst and extending to the apex, arranged in groups towards the distal end.

Outer uropod (Fig. 1*b*) slightly longer than the inner, distal joint half as long as the proximal and not quite twice as long as broad; outer margin of the proximal joint armed by twelve spines which occupy rather more than half the margin.

Length of adult specimens of both sexes, 9 mm.

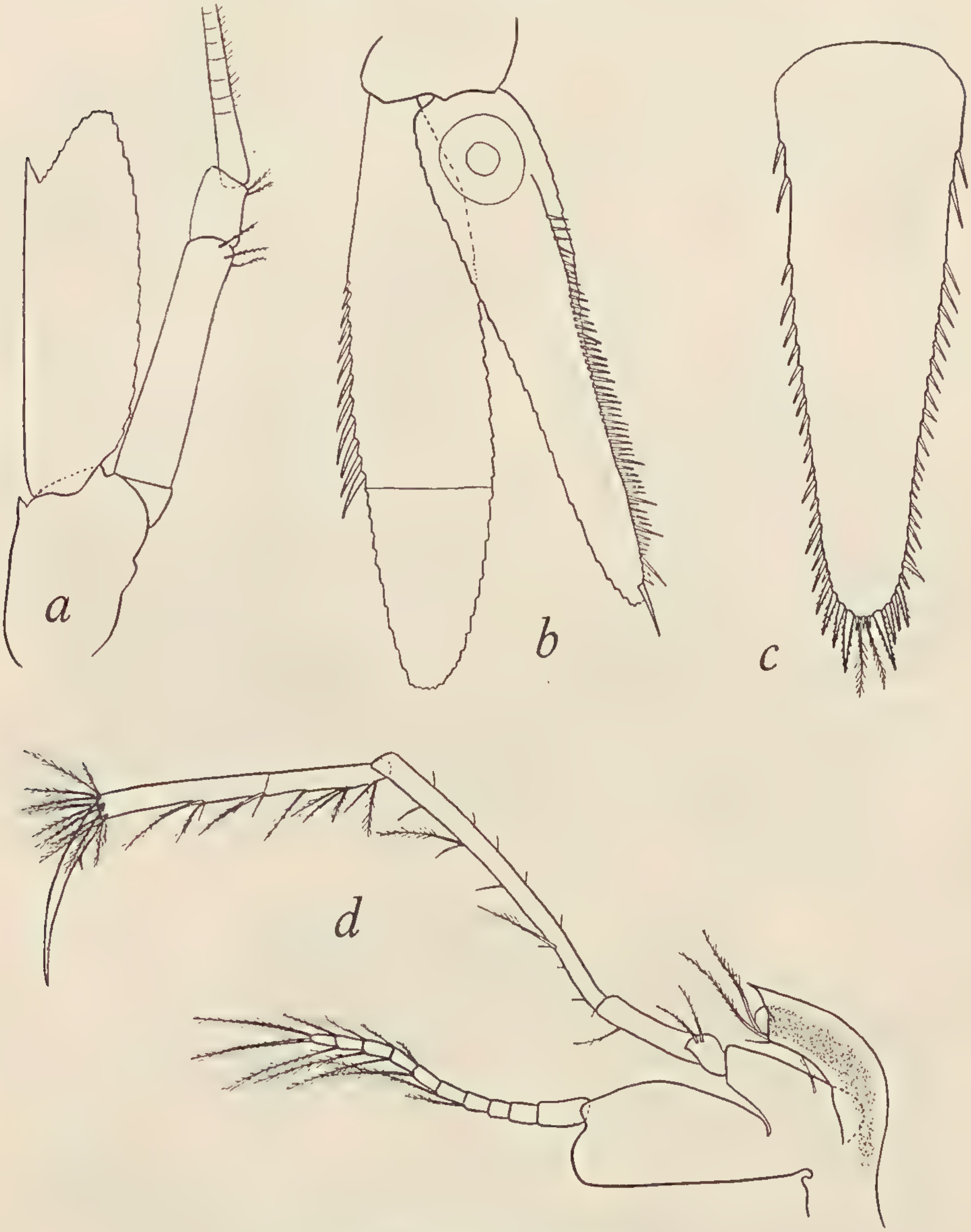

Fig. 1.—*Siriella longidactyla*, n. sp.

a. Antennal scale and peduncle. *b*. Uropods. *c*. Telson. *d*. Eighth thoracic limb of male with copulatory organ. All figures × 49.

Remarks.—The genus *Siriella* is a very difficult one. It includes at the moment thirty-four more or less distinct species, in addition to the present one. These species are exceedingly difficult to distinguish and can in some cases only be identified with certainty after the examination of adult male specimens. Hansen (1910) has suggested a grouping of the species into four sections, but this grouping only applies to Asiatic species (and not to all of these) and is not comprehensive enough to permit the inclusion of the remaining species.

S. longidactyla could be included in Hansen's group 2 except for the fact that the fourth pair of pleopods in the male have no modified setae at the apex of the branches. Most of the European species of the genus agree with *S. longidactyla* in this respect. If, therefore, Hansen's group 2 were further divided into (*a*) those in which none of the male pleopods have modified setae and (*b*) those in which some of the male pleopods have modified setae at the apex of the branches, it would be more useful as a basis for the grouping of the species.

Group 2*a* would then include the following species, to the exclusion of all other species of the genus: *armata, frontalis, norvegica, brooki, jaltensis, gordonae, clausii* and *longidactyla*. Of these eight species, *S. armata* and *S. frontalis* are distinguished at once by the very long acutely pointed rostral plate extending as far forward as the distal end of the second joint of the antennular peduncle. *S. norvegica, S. brooki, S. jaltensis* and *S. gordonae* form a group of species in which the median spinule of the three spinules between the long spines at the apex of the telson is about twice as long as the lateral ones. This leaves *S. clausii* as the nearest relative of *S. longidactyla*. The latter may be distinguished from *S. clausii* by the fact that the antennal scale does not possess a distal joint, by the longer and more slender endopods to the thoracic limbs, and especially by the very long dactylus of these limbs, by the different arrangement of the spines on the telson and uropods, by the more densely feathered setae on the male pleopods and by the shape of the male copulatory organ.

Among Australasian species of the genus, *Siriella longidactyla* comes nearest to *S. denticulata* from New Zealand. In the latter species, however, the spines on the outer margin of the proximal joint of the outer uropods occupy less than half the margin, there are only seventeen spines on the inner margin of the inner uropods, the arrangement of the spines on the telson is different and the dactylus of the thoracic endopods much shorter.

Subfamily RHOPALOPHTHALMINAE.

Genus **Rhopalophthalmus** Illig.

Rhopalophthalmus egregius Hansen.

R. egregius Hansen, 1910, p. 49; Nakazawa, 1910, p. 255; Tattersall, 1915, p. 151; Colosi, 1918, p. 6; Colosi, 1920, p. 237; Tattersall, 1921, p. 408; Tattersall, 1922, p. 457; Sewell and Annandale, 1922; Aiyar and Menon, 1936; Tattersall, 1936, p. 147; Pannikar and Aiyar, 1937.

Occurrence.—Lake Illawarra, April 1937, enormous numbers of both sexes.

Distribution.—East Indian Archipelago (Hansen); Japan (Nakazawa); several localities on the east coast of India (Tattersall, Aiyar and Menon, Pannikar and Aiyar); Siam (Tattersall); Torres Strait (Colosi); Great Barrier Reef (Tattersall); between New Caledonia and New Zealand (Colosi). The species is a shallow water form and usually planktonic. It is frequently found in brackish water, as, for instance, in Lake Chilka, India, Madras, and the Talé Sap, Siam. It is a gregarious species and occurs generally in immense swarms. It is evidently widely distributed in the Indo-Pacific region.

Subfamily GASTROSACCINAE.

Genus **Anchialina** Norman.

Anchialina penicillata Zimmer.

A. penicillata Zimmer, 1915, p. 161.

Occurrence.—Port Stephens, June 1938, five males and one female.

Remarks.—The setae on the antennules of the male are only present in completely adult specimens, and are not developed in immature forms.

Distribution.—The type specimen was found in a collection of plankton made between Ceylon and the Dampier Strait. No other specimens are recorded.

Genus **Gastrosaccus** Norman.

Gastrosaccus indicus Hansen.

(Fig. 2*a*–2*h*.)

G. indicus Hansen, 1910, p. 56.

G. indicus Tattersall, 1911, p. 125.

Occurrence.—Port Stephens, June 1938, eleven females, twelve males and one immature.

Remarks.—These specimens agree very closely with Hansen's description and figures. I have figured the main features of an adult male from the present material for comparison with Hansen's figures. The closest agreement is manifested. I should perhaps explain that, in the preparation from which Fig. 5*f* was made, the lobe from the basal joint of the exopod of the third pair of pleopods of the male, which probably represents the endopod, had become folded under the exopod. In the unmounted condition it is exactly as figured by Hansen.

Distribution.—East Indian Archipelago (Hansen); Indian Ocean near the Seychelles (Tattersall). Its occurrence off the coast of Australia marks a considerable extension of its known geographical distribution.

Gastrosaccus dakini, n. sp.

(Figs. 3*a*–3*c*, 4*a*–4*f*.)

Occurrence.—Lake Illawarra, April 1937, ten females, fourteen males and two immature, 11 mm.

Description.—A species of the *G. normani* group.

Carapace with a short triangular rostral plate below which is a prominent acute spiniform subrostral process. No lobes or filaments on the posterior dorsal margin of the carapace and no median dorsal process on the fifth abdominal somite.

Eyes small, pigment black, cornea rather shorter than the eyestalk and twice as broad as long.

Antennular peduncle with the first joint longer than the combined length of the second and third; second joint quite short with two spines on the outer margin.

Antennal peduncle with the second joint about twice as long as the third and extending forward to the level of the distal end of the first joint of the antennular peduncle.

Antennal scale (Fig. 3*a*) reaching forward to about the distal end of the second joint of its peduncle; three times as long as broad; no suture across the terminal lobe.

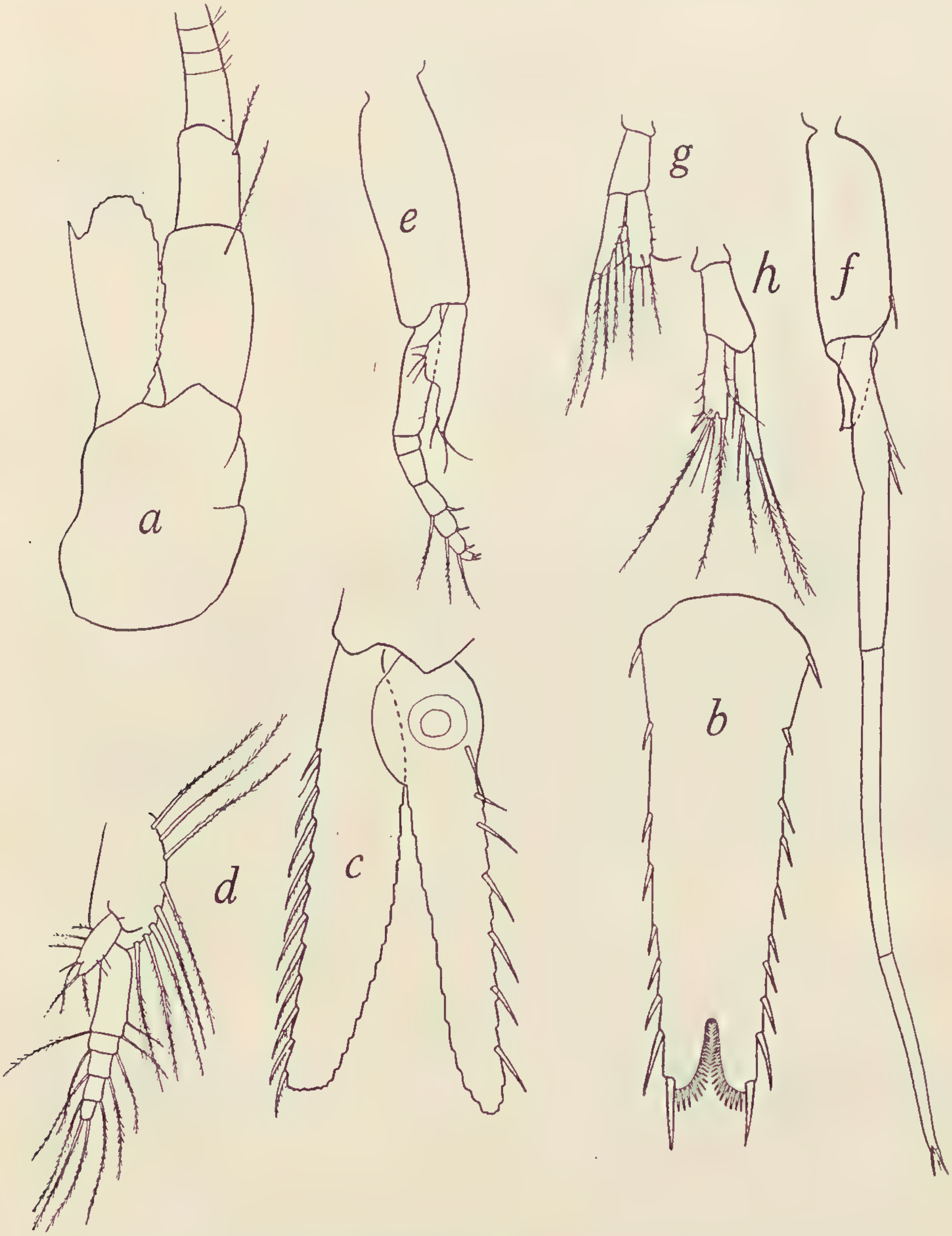

Fig. 2.—*Gastrosaccus indicus* Hansen.

a. Antennal scale and peduncle. *b.* Telson. *c.* Uropods. *d.* First pleopod of male. *e.* Second pleopod of male. *f.* Third pleopod of male. *g.* Fourth pleopod of male. *h.* Fifth pleopod of male. *f* × 42; all other figures × 49.

Telson (Fig. 3*c*) slightly more than two and a half times as long as broad at the base; terminal cleft about one-ninth of the total length; lateral margins armed with seven spines, rather widely spaced, the terminal and penultimate of which are much longer than the others.

Uropods (Fig. 3*b*) slightly longer than the telson; exopod with fourteen spines on the outer margin; endopod with six spines on the inner margin.

First pleopod of the male (Fig. 4*a*) with the endopod very short and composed of one joint only, the exopod nine-jointed.

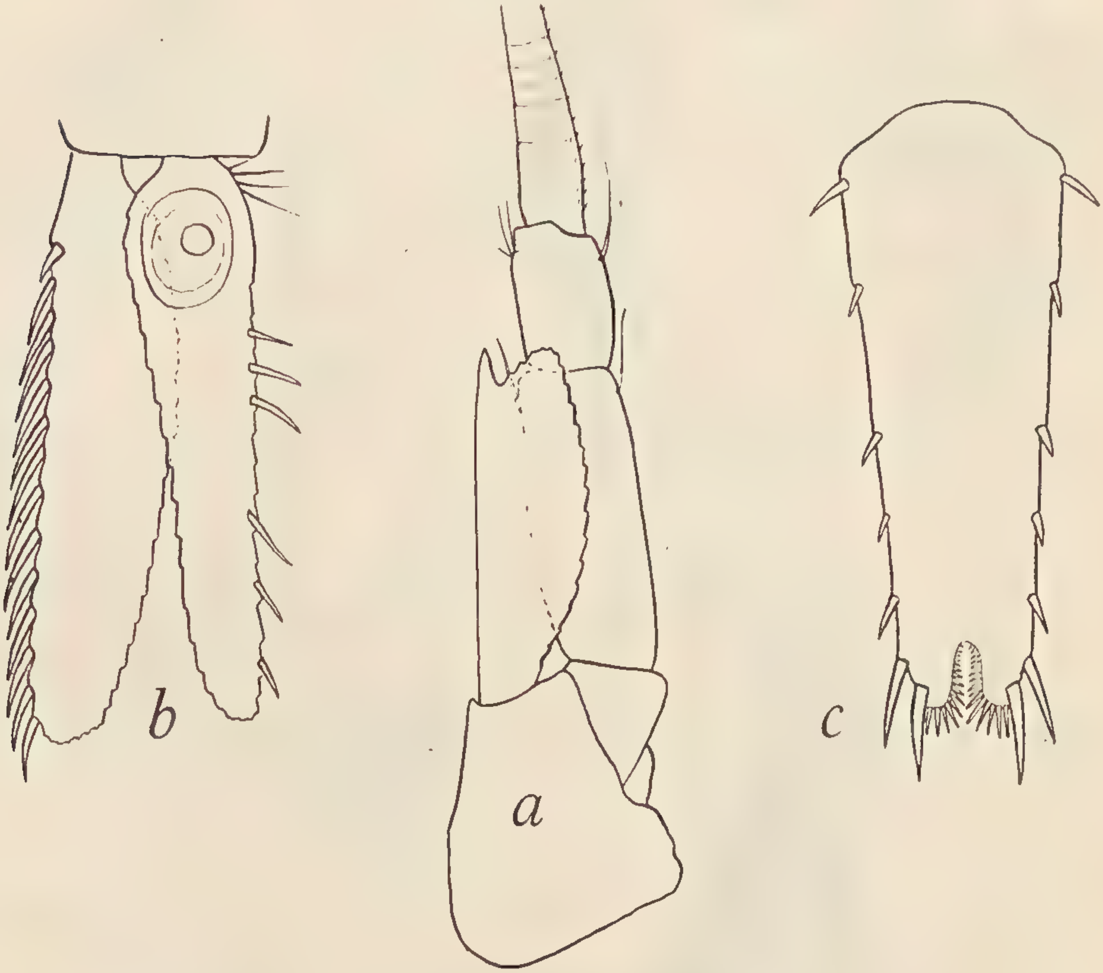

Fig. 3.—*Gastrosaccus dakini*, n. sp.
a. Antennal scale and peduncle. *b*. Uropods. *c*. Telson. All figures × 49.

Second pleopod of the male (Fig. 4*b*) with the protopodite as long as the endopod; endopod six-jointed, slightly curved, terminal joint with two simple setae; basal joint with three long simple setae on the inner margin; second joint with a single simple and rather long seta; third, fourth and fifth joints unarmed; exopod slightly curved, composed of nine joints; sixth, seventh and eighth joints with a long plumose seta on the outer distal corner and a short simple seta on the inner corner; terminal joint with two simple somewhat curved setae.

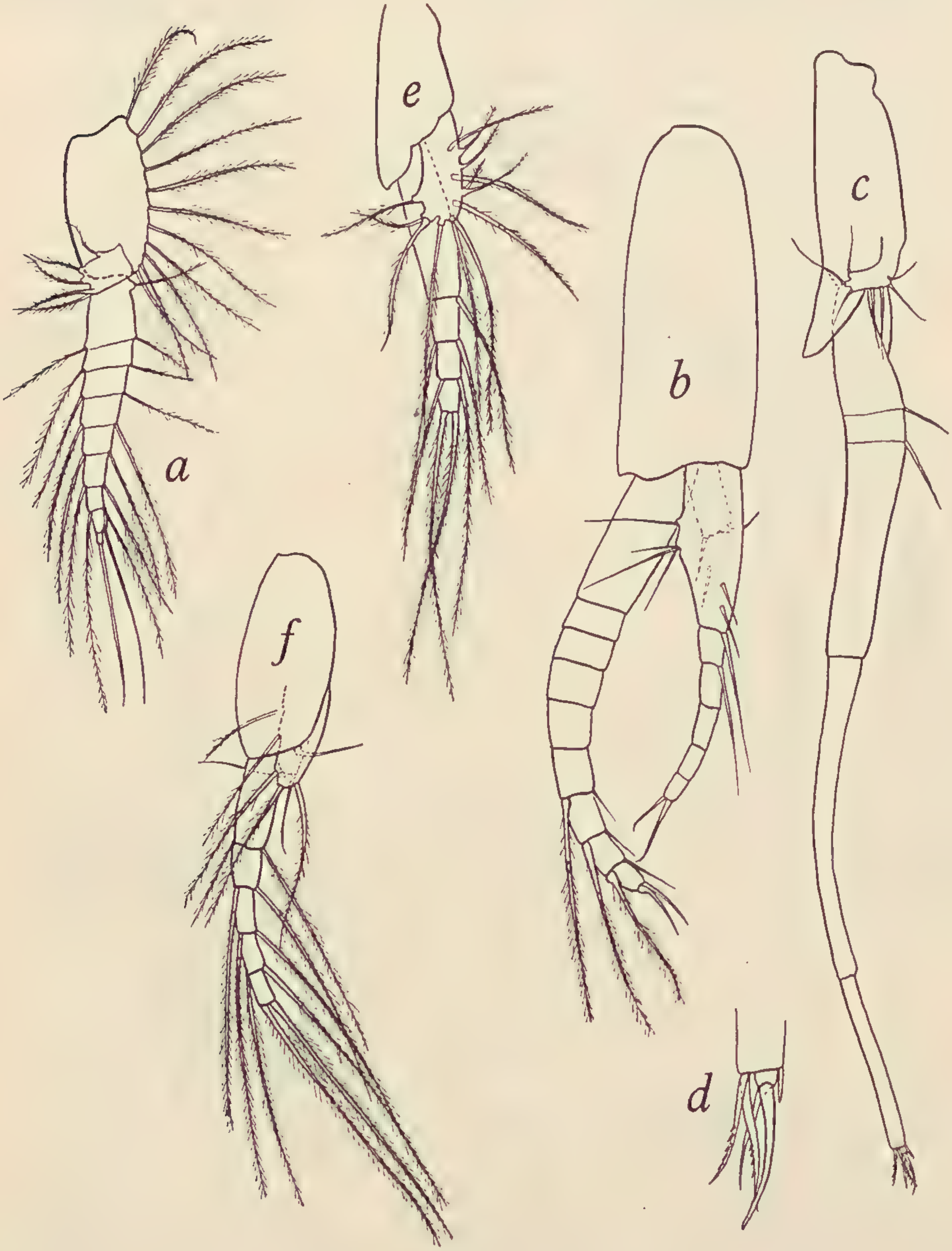

Fig. 4.—*Gastrosaccus dakini*, n. sp.

a. First pleopod of male. *b*. Second pleopod of male. *c*. Third pleopod of male. *d*. Distal end of third pleopod of male. *e*. Fourth pleopod of male. *f*. Fifth pleopod of male. *a* and *c* × 42; *b*, *e* and *f* × 73; *d* × 127.

Third pleopods of the male (Figs. 4*c* and 4*d*) very long, reaching backward almost to the end of the telson; endopod represented by a short pointed lobe which appears to be fused with the peduncle; exopod composed of three joints (the joints are very difficult to make out, and in one specimen there appear to be four joints), first joint the longest and broadest with two setae at the middle of the outer margin, terminal joint with four setae and one small spine, two of the setae at least being barbed.

Fourth and fifth pleopods of the male (Figs. 4*e* and 4*f*) essentially similar to one another, with the endopod composed of a single joint and the exopod with four joints in the fourth pair and five in the fifth.

Remarks.—The species of the genus *Gastrosaccus*, like those of *Siriella*, are notoriously difficult to separate. The genus is at present comprised of nineteen species, but, in many cases, certain identification can only be made by examination of adult males, since it is on the characters of the male pleopods that specific distinction is based. The following summary of the known species will serve to indicate the relationships of this new species.

I. Fringe of filaments on the posterior dorsal margin of the carapace.
    a. Spinous process on the fifth abdominal somite.
        G. spinifer.
    b. No process on fifth abdominal somite.
        G. muticus.
        G. simulans.
II. Reflected lobes on the posterior dorsal margin of the carapace.
        G. sanctus.
        G. dunckeri.
III. No filaments or reflected lobes on the carapace.
    a. Spinous process on the fifth abdominal somite.
        G. australis.
        G. dissimilis.
    b. No spine on the fifth abdominal somite.
        Telson with small spines between the major spines.
            G. kempii.
        No subsidiary spines on the telson.
            G. kojimanus.
            G. parvus.
            G. indicus.
            G. pacificus.
            G. erythraeus.
            G. bengalensis.
            G. vulgaris.
            G. normani.
            G. pusillus.
            G. johnsoni.

Gastrosaccus dakini belongs to the last group of species, which are mainly separated on the structure of the male pleopods. I have compiled a table showing the chief characters of this group of species, and have inserted this new species in its appropriate place so that its position among the other species can be seen at a glance.

Species.	Male Pleopods.										Spines on Telson.	Spines on Outer Uropod.	Spines on Inner Uropod.	Remarks.
	1		2		3		4		5					
	Joints in Exopod.	Joints in Endopod.	Joints in Exopod.	Joints in Endopod.	Joints in Exopod.	Joints in Endopod.	Joints in Exopod.	Joints in Endopod.	Joints in Exopod.	Joints in Endopod.				
pacificus ..	5	1	6	1	3	R	1	1	1	1	12	12	4	
indicus ..	5	1	6	1	4	R	1	1	1	1	10	13	5	
parvus ..	4	1	5	6	5	R	1	1	1	1	8	10	4	
pusillus ..	4	1	9	7	5	1	1	1	1	1	8	12	4	
johnsoni ..	4	1	7	1	3	1	2	1	2	1	9	13	2	Very complicated pleopod three.
vulgaris ..	7	1	7	1	4	1	3	1	3	1	8	14	6	
erythraeus ..	5	1	5	4	5	1	3	1	3	1	9	11	5	
bengalensis ..	6	1	9	6	4	1	3	1	3	1	13	13	?	
dakini ..	9	1	9	6	3	1	4	1	5	1	7	14	6	
normani ..	8	1	9	6	4	1	3	1	3	1	9	13	7	
kojimanus ..											14	20	10	Structure of pleopods not detailed.

R=rudimentary or fused with the exopod.

It will be seen that *G. dakini* is most nearly allied to *G. bengalensis* Hansen. The pleopods of the male are very similar, but in *G. bengalensis* the exopod of the first pleopod has six joints as against nine in *G. dakini*, and the fourth and fifth pairs have three joints in the endopod as against four and five in *G. dakini*. The number of spines on the margins of the telson forms the most easily seen difference between the two species, seven in *G. dakini* and thirteen in *G. bengalensis*.

G. dakini is readily separated from *G. indicus* by the form of the pleopods of the male, especially the form of the fourth and fifth pairs. The females are closely allied, but *G. indicus* has a somewhat longer and narrower telson, with ten spines on the lateral margins as against seven in *G. dakini*.

Subfamily MYSINAE.

Tribe LEPTOMYSINI.

Genus **Afromysis** Zimmer.

Afromysis australiensis, n. sp.

(Figs. 5*a*–5*g*, 6*a*–6*d*.)

Occurrence.—Broken Bay, April 1937, fifty-six males and twenty females, 7 mm.

Description.—Carapace rather short, leaving the last three thoracic somites exposed; produced in front into a short rostral plate not extending forward beyond the base of the eyestalk; apex obtusely pointed and depressed in lateral view; antero-lateral corners rounded.

Eye (Fig. 5*a*) short, not extending beyond the distal end of the basal joint of the antennular peduncle, cornea almost as large as the eyestalk, pigment black.

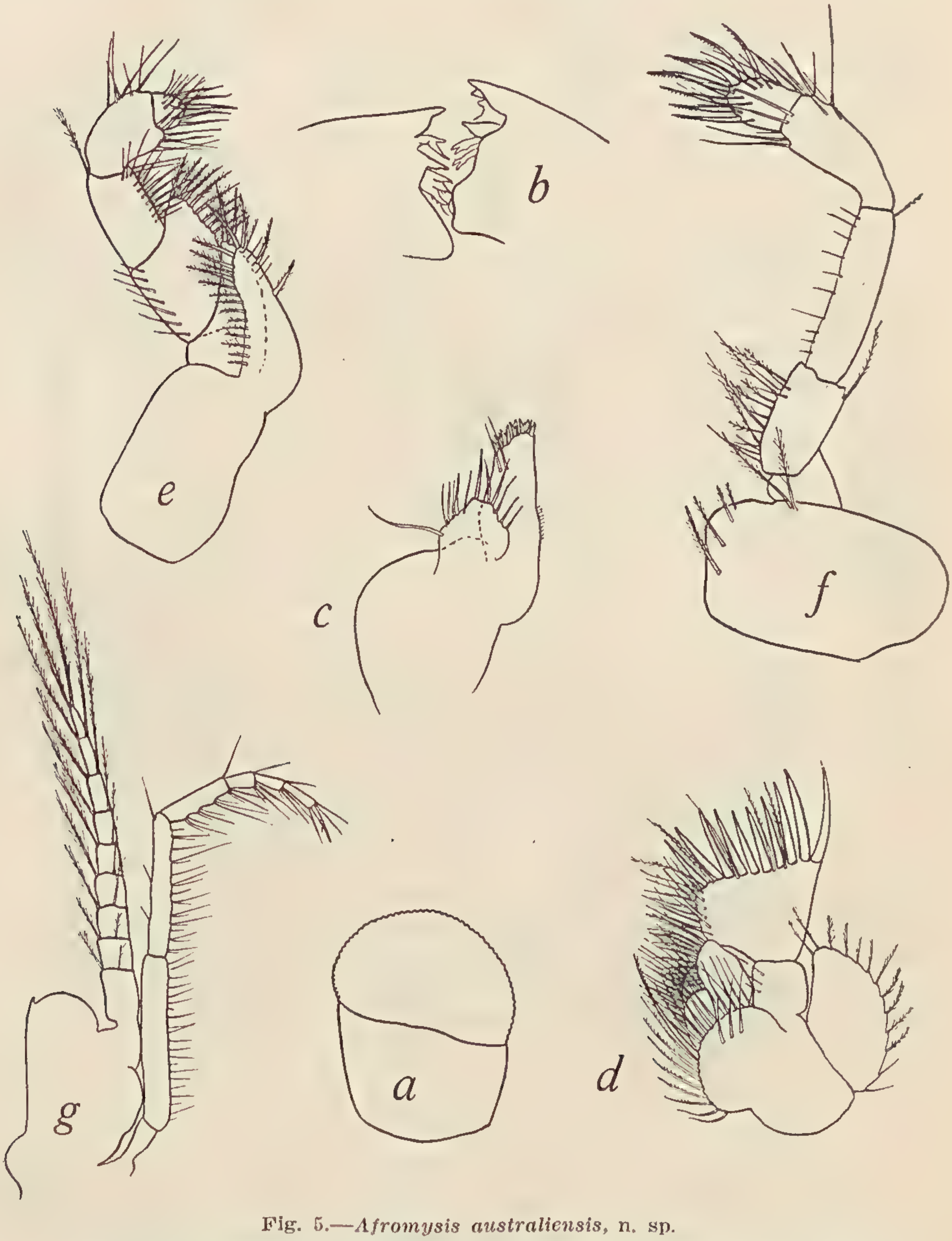

Fig. 5.—*Afromysis australiensis*, n. sp.

a. Eye. *b*. Mandibles. *c*. Maxillule. *d*. Maxilla. *e*. Endopod of first thoracic limb. *f*. Endopod of second thoracic limb. *g*. Third thoracic limb. *a* and *g* × 49; all other figures × 91.

Antennal scale (Fig. 6*a*) six times as long as broad, setose all round, a distal joint clearly marked off and equal to one-ninth of the total length of the scale, a prominent spine on the outer corner of the joint from which the scale arises. The scale extends for one-quarter of its length beyond the distal end of

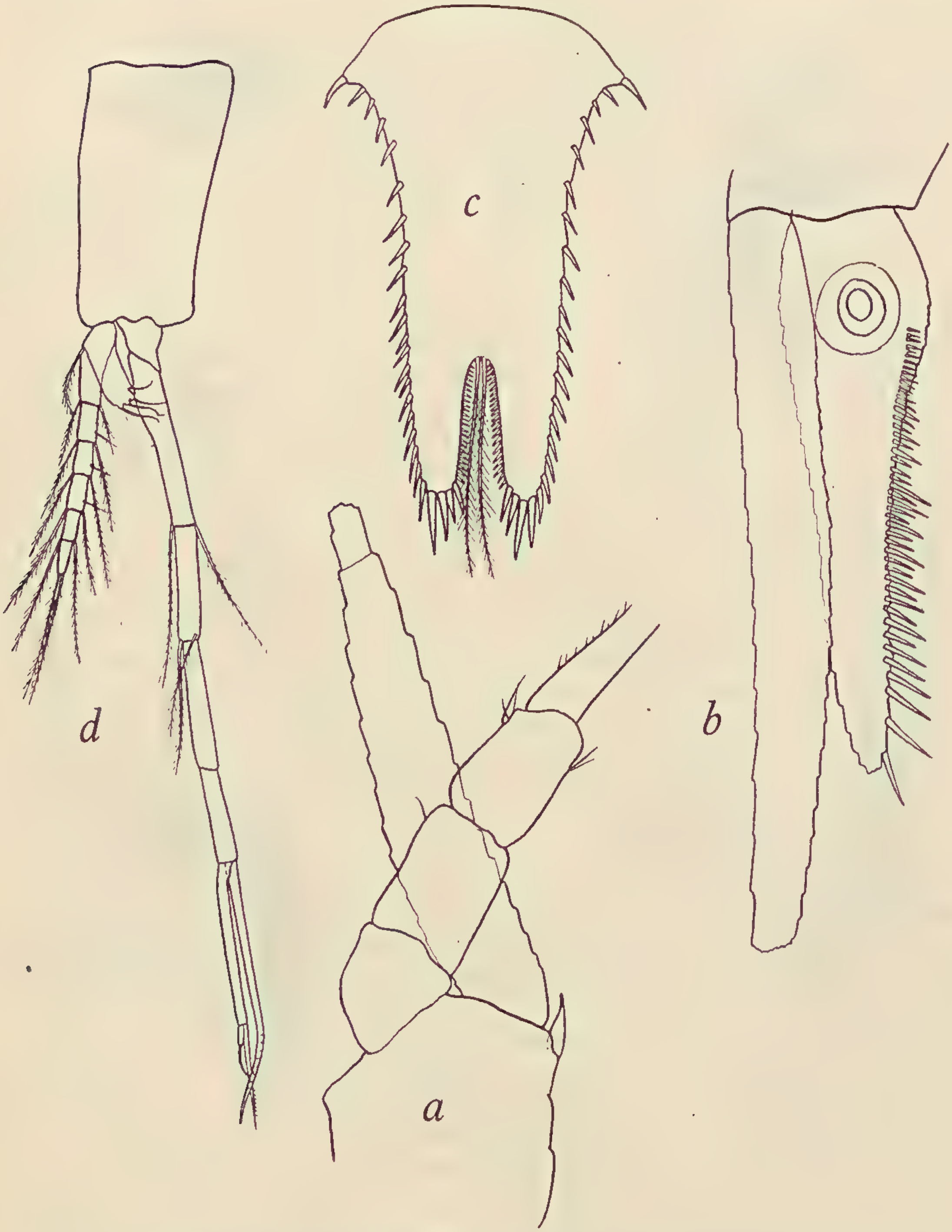

Fig. 6.—*Afromysis australiensis*, n. sp.

a. Antennal scale and peduncle. *b.* Uropods. *c.* Telson. *d.* Fourth pleopod of male. *a, b* and *c* × 84 ; *d* × 67.

the antennular peduncle. The antennal peduncle is equal to the combined length of the first two joints of the antennular peduncle and has the second and third joints subequal in length.

The details of the mouth parts, the endopods of the first and second thoracic limbs and a complete third thoracic limb are shown in Figs. 5*b*, 5*c*, 5*d*, 5*e*, 5*f* and 5*g*, and need not be further described. The outstanding feature of the genus is the form of the terminal joint of the palp of maxilla (Fig. 5*d*), which is exceptionally broad and strongly armed. The outer distal corner of this joint is not so much produced as it is in the type species nor as in *A. macropsis*, but is essentially of the same form. The protopodite of the third to the eighth thoracic limbs is divided into four joints and the large basal joint of the exopod has an acute spine at the outer corner.

Telson (Fig. 6*c*) one and three-quarter times as long as broad at the base; deeply cleft at the apex, the cleft three-eighths of the total length of the telson and armed on each side by twenty-three small spines and a pair of long plumose setae; apical lobes of the telson armed by four stout spines, the outer of which is about one-eighth of the length of the telson, the remaining three each slightly shorter than its outer neighbour; lateral margins of the telson armed by about twenty spines extending the full length of the margins.

Inner uropod (Fig. 6*b*) extending for about half its length beyond the distal end of the telson; inner margin armed by a row of about forty-eight rather stout spines commencing at the level of the statocyst and extending practically to the apex, the proximal spines short, the distal spines rather long and the whole showing a graduated series in regard to size, with a tendency to be arranged in series of shorter and longer spines.

Outer uropod about twice as long as the telson.

Pleopods of the male as in the genus *Leptomysis*; fourth pair greatly elongate and reaching backward to the distal end of the telson, exopod long and modified, composed of seven joints, fifth joint with a very long and strong seta on the outer corner, sixth joint with a similar but smaller seta, seventh joint with a slightly curved simple seta at its apex. The fourth pleopod is very similar to that of the type species, *A. hansoni* Zimmer, 1916.

Length of adults of both sexes, 7 mm.

Remarks.—Three species of the genus *Afromysis* are now known: the type *A. hansoni* Zimmer, *A. macropsis* Tattersall, and the present species. *A. hansoni* is known from the west coast of South Africa, and *A. macropsis* from the Orissa coast of India. The Australian species is distinguished from the other two by the combination of characters afforded by the maxilla, telson and antennal scale, and by the fourth pleopod of the male.

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AN AUSTRALIAN SPECIES OF *ACETES* (CRUSTACEA MACRURA, SERGESTIDAE), WITH REMARKS ON THE DISTRIBUTION AND LITERATURE OF THE GENUS.

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(Figures 1–19.)

Introductory.—The genus *Acetes* was established by Milne Edwards in the year 1830 (*A. indicus*), and since that time sixteen species and one subspecies have been added; these are set forth in the distribution table given below, and the present species, which is described for the first time, brings the total up to eighteen.

Distribution.—*Acetes* is one of the Sergestidae, a notably planktonic group, and, whilst *Acetes* may be taken in the tow-net at times, it also appears to frequent the shallow brackish flats found in estuaries, where salinity is low and the bottom muddy. To quote Kemp (1917): "The species of *Acetes* are found gregariously swimming in great numbers in mid-water or near the surface. They are apparently met with only in coastal waters; they occur near the shore in the open sea, and are frequently common in estuaries and backwaters. They are often found in water of low salinity and occasionally in places where it is quite fresh, but penetrate little if at all beyond the reach of tidal influence. The species are fished commercially in India and Japan, the small size of the individuals being evidently compensated by the great abundance in which they are taken."

To this may be added a note by Hansen (1933): "With bobbinet around the tip of the otter trawl, this *Acetes* [*A. carolinae*] sometimes is obtained in gallons at a time, especially in late summer and early fall."

Hansen (1919) records *A.* dispar from a mangrove swamp in the Gulf of Siam, and some specimens of *A. australis* were taken in a shallow muddy bay in Port Jackson (Sydney Harbour), using a bottom dredge.

The following table gives the distribution of all the species that the author has been able to discover in the available literature:

Acetes indicus Milne Edwards.
  Ganges Delta (Milne Edwards, 1830); Gulf of Siam (Kemp, 1917); S. end of Durian Strait, East Indies (Boone, 1935).

A. erythraeus Nobili.
  Red Sea (Nobili, 1905); W. side of Bay of Bengal, Penang, Gulf of Siam (Kemp, 1917); French Somaliland (Burkenroad, 1934).

A. insularis Kemp.
  Rajang R., Sarawak, Borneo (Kemp, 1917).

A. japonicus Kishinouye.
Inland Sea of Japan, Korea (Kishinouye, 1905); W. and S. coasts of India, Bay of Bengal, and Gulf of Siam (Kemp, 1917); Port Swettenham, Selangor (Burkenroad, 1934).

A. americanus Ortmann.
Mouth of Amazon Estuary (Ortmann, 1893).

A. americanus limonensis Burkenroad.
Limon Bay, Canal Zone, Panama (Burkenroad, 1934).

A. carolinae Hansen.
Beaufort Inlet, Nth. Carolina (Hansen, 1933); Louisiana coast (Burkenroad, 1934).

A. vulgaris Hansen.
Djangkar Java, Bay of Bima, Sumbawa, Surabaya and Cheribon Java, Malakka, and Gulf of Siam (Hansen, 1919).

A. sibogae Hansen.
Bay of Bima, Sangkapura-roads Bawean Is. (Hansen, 1919).

A. serrulatus Kroyer.
Surabaya, Cheribon, "Indo-Chinese Sea" (Hansen, 1919).

A. dispar Hansen.
Cheribon Java, Gulf of Siam (Hansen, 1919).

A. spiniger Hansen.
Surabaya Java, Rangoon, Indo-China Seas (Hansen, 1919).

A. chinensis Hansen.
Formosa Channel, Lat. 33 10 N. by 129 18 E. (Hansen, 1919).

A. brasiliensis Hansen.
Brazil (Hansen, 1919).

A. paraguayensis Hansen.
Rio Paraguay, Rio de la Plata (Hansen, 1919).

A. sp. Hansen.
Bay of Bima (Hansen, 1919).

A. binghami Burkenroad.
Bella Vista Beach Panama City (Burkenroad, 1934).

Literature.—As may be expected, a moderately extensive taxonomic literature on *Acetes* has been published, and as this is scattered through many different periodicals, it has been considered worth while to give a complete list for the assistance of those who may be working on this genus at any time.

Apart from records of occurrence of *A. indicus* by Dana (1852), Walker (1890), Henderson (1893), and Pearson (1905), the literature is distributed among nine authors as set out below.

Acetes indicus Milne Edwards.
Milne Edwards, Ann. Sci. Nat., Paris, xix, 1830, p. 351, pl. xi, figs. i–ix; and Hist. Nat. Crustacea, ii, 1837, p. 430. *Id.*, Dana, U.S. Explor. Exped., Crustacea, 1852, i, p. 608. *Id.*, Walker, Journ. Linn. Soc. Zool., xx, 1890, p. 112. *Id.*, Henderson, Trans. Linn. Soc. Zool., (2) v, 1893, p. 452. *Id.*, Pearson, Ceylon Pearl Oyster Fisheries, Rep. iv, 1905, p. 75. *Id.*, Kemp, Rec. Ind. Mus., xiii, 2, 1917, p. 47, figs. 1*a*, 1*b*, 2*a*, 3*a*. *Id.*, Boone, Bull. Vanderbilt Marine Museum, vi, 1935, pp. 101–105, pl. 25, text-fig. 9.

Acetes erythraeus Nobili.

Nobili, Bull. Mus. d'Hist. Nat., Paris, 1905, p. 394, fig. 1. *Id.*, Nobili, Ann. Sci. Nat. Paris (9), 1906, p. 23, pl. i, figs. 5, 5*a–f*. *Id.*, Kemp, Rec. Ind. Museum, xiii, 2, 1917, text-figs. 1*c–e*, 2*b*, 3*b*, 4*b*, 5*a–d* and 7*b*.

Acetes insularis Kemp.

Id., Kemp, *loc. cit.*, text-figs. 1*f*, 1*g*, 2*c*, 3*c*, 4*c*, 4*b*, 4*e*, 7*c*.

Acetes japonicus Kishinouye.

Kishinouye, Annot. Zool. Japon., v, 1905, p. 163, figs. (2). *Id.*, Kemp, *loc. cit.*, figs. 1*h*, 1*i*, 2*d*, 3*d*, 4*d*, 5*f*, 6, 7*d*. *Id.*, Burkenroad, Bull. Amer. Mus. Nat. Hist., lxviii, 1934, p. 127.

Acetes americanus Ortmann.

Ortmann, Ergebn. Plankton Expedition der Humboldt Stiftung, ii, Gb, 1839 (Decapoden und Schizopoden), p. 39, pl. 2, fig. 2. *A. americanus* (*limonensis*, sub-sp. nov.) Burkenroad, Bull. Bingham Oceanographical Coll., iv, 1934, art. 7.

Acetes carolinae Hansen.

Hansen, Journ. Washington Acad. Sci., xxiii, 1, 1933, pp. 30–34, text-figs. 1–8. *Id.*, Burkenroad, Bull. Amer. Mus. Nat. Hist., lxviii, 1934, art. 2, p. 128, fig. 15. *A.* sp. Brookes, Phil. Trans. Roy. Soc. London, clxxiii, 1882, art. 2.

Acetes vulgaris Hansen.

Hansen, Siboga, Mon. xxxviii (Sergestidae), 1919, pp. 35–7, pl. iii, figs. 2*a–2r*.

Acetes sp. Hansen.

Hansen, *loc. cit.*, pp. 37–8, pl. iii, fig. 3*a*.

Acetes sibogae Hansen.

Hansen, *loc. cit.*, pp. 38–9, pl. iii, figs. 4*a–h*.

Acetes dispar Hansen.

Hansen, *loc. cit.*, pp. 39–41, pl. iii, figs. 5*a–f* and pl. iv, fig. 1*a*.

Acetes spiniger Hansen.

Hansen, *loc. cit.*, pp. 43–4, pl. iv, figs. 5*a–h*.

Acetes chinensis Hansen.

Hansen, *loc. cit.*, p. 41, pl. iv, figs. 3*a*, 3*b*.

Acetes brasiliensis Hansen.

Hansen, *loc. cit.*, pp. 45–6, figs. 1–7.

Acetes paraguayensis Hansen.

Hansen, *loc. cit.*, pp. 46–8, text-figs. 8–14.

Acetes serrulatus Kroyer.

Kroyer, Kgl. d. Vid. Selsk. Skrifter, Math-nat Afdeling, iv, 2, 1859, p. 268, tab. 4, figs. 12*a–g*. *Id.*, Hansen, *loc. cit.*, pp. 41–3, pl. iv, figs. 4*a–4h*.

Acetes binghami Burkenroad.

Burkenroad, Bull. Bingham Oceanographical Coll., iv, art. 7, 1934.

Of the above papers, that of Burkenroad (1934) is specially worthy of mention, for in addition to some valuable data on *A. carolinae* and *A. japonicus*, he points out that many of the so-called valid species are probably synonyms:—

> *Acetes carolinae* Hansen and *A. americanus* Ortmann, and *A. brasiliensis* Hansen, may be regarded as forming a subdivision of *Acetes* distinguished from the remaining species of the genus by the lack of a second rostral tooth between the rostral tip and the posterior tooth, the absence of a stout distally directed spine or spines from the proximal part of the inferior antennular flagellum of the male, and the absence of a podobranch from the second maxillipeds. Hansen has stated that a podobranch is present on this somite throughout the genus. Kemp (1917) finds this description applicable to the Indo-Pacific species, but Ortmann (1893)

states that a podobranch is absent from the second maxillipeds of *A. americanus.* I do not find a podobranch in *A. carolinae.* The second division seems to contain eight species of which one, *A. paraguayensis* Hansen, occurs in the American South Atlantic. The remaining species of the second division occur in the Indo-Pacific, and may be listed as follows:

1. *A. serrulatus* (Kroyer) Hansen, 1919, with which *A. insularis* Kemp, 1917, seems synonymous.
2. *A. indicus* M.E., with which *A. spiniger* Hansen seems synonymous.
3. *A. sibogae* Hansen, which perhaps includes the specimens reported by Kemp as dimorphic males of *A. erythraeus* Nobili, with elongate third segment of the antennular peduncle.
4. *A. erythraeus* Nobili, Kemp, 1917, with which *Acetes species* Hansen seems synonymous. I have examined a male of this species from French Somaliland.
5. *A. vulgaris* Hansen, which seems to differ somewhat from *A. erythraeus* by its more numerous series of spines of different arrangement on the fifth joint of the lower antennular flagellum of the male, and the absence of a lobule from the segment in front of the clasping spine; the presence of a spine at the distal inner angle of the coxa of the third legs of the male and the absence as figured of a spine from the outer margin of the exopod of the uropod; and the longer median lobe of the capitulum of the petasma which bears three large spines and lacks the numerous smaller ones of *A. erythraeus* except near the tip. Hansen reports that the female bears a pair of sternal protuberances between the coxae which are absent in *erythraeus,* but faint elevations in this position are figured by Kemp for the latter species.
6. *A. chinensis* Hansen, apparently related to *A. japonicus,* but of which the characters are as yet incompletely known.
7. *A. japonicus* Kishinouye, Kemp, 1917, with which *A. dispar* Hansen seems to be synonymous. A negative distinction is made by Hansen between his form and Kishinouye's; that the sexual difference in the third segment of the antennular peduncle of *A. dispar* could not have been overlooked by Kishinouye if present in *A. japonicus.* This means of differentiation seems to be doubtful in view of Kemp's examination of the Japanese material, which he finds identical with the Indian specimens, and which therefore displays differences in the antennular peduncle. Kemp further notes variations in the length of processus ventralis of the petasma sufficient to obscure the differences mentioned by Hansen.

The larval development of *Acetes* is described in papers by Brookes,[1] Soyejima,[2] and Menon.[3] The paper by Soyejima was unfortunately unprocurable, a fact to be regretted because it appears to be very important, whilst that of Menon gives admirable figures and descriptions of the development of *A. erythraeus,* and reveals the interesting fact that in the larvae the chelae of the walking legs are very prominent. In the adult, as will hereafter be described, they are so minute that they easily escape notice at first.

Material.—The actual material on which this paper is based came from Mr. G. L. Kesteven, B.Sc., of the Council for Scientific and Industrial Research, Fisheries Branch, to whom I should like to express my thanks. He provided a series of eight females and four males that he dredged up in Homebush Bay, Port Jackson (Sydney Harbour), in June, 1937. He provided a further series of 97 females and 150 males which were collected at Folly Point, Middle Harbour, Port Jackson, in 1922, by an inspector of the State Fisheries Branch and labelled "Prawn Fry".

I am also indebted to Miss Isobel Bennett of the Zoology Department, University of Sydney, for three females and four males from the Clarence River, North Coast of New South Wales, and finally to Mr. T. C. Roughley, B.Sc., of the

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[1] Brookes.—Roy. Soc. Lond., Phil. Trans., clxxiii, 1883, p. 101.
[2] Soyejima.—Suisan Gakkwai Ho, iv, 1926, p. 15.
[3] Menon.—Madras Govt. Museum, Bull. (n.s.), iii, 3.

State Fisheries, Chief Secretary's Department, who sent along large numbers of males and females collected at Tuggerah Lake, 50 miles north of Port Jackson. They were reported as being very numerous in that locality during the month of May, 1939.

It is quite likely that the species ranges along most of the coast of New South Wales.

SERGESTIDAE Dana.

SERGESTINAE Bate.

Acetes H. Milne Edwards.

Body rather slender. Carapace produced into a short rostrum behind which is a crest armed with one or two denticles. Hepatic and supraorbital spines well developed. Antennules with second peduncular joint somewhat short; third joint in female considerably longer than, in the male from twice to three times as long as, the second; outer antennular flagellum of male modified into a clasping organ. Mandibles with long three-jointed palp, the first segment of which is very inconspicuous, and the second elongate. Maxillules with only two lobes. Maxillae with undivided protopodite, and with well-developed endopodite and exopodite. First pair of maxillipeds two-lobed and jaw-like, with epipodite but no gill. Second pair of maxillipeds more leg-like, with or without gill (podobranch). Third pair of maxillipeds long and slender, but shorter than the third pair of legs; the second joint usually, but not always, fused with the third; the two distal joints not subdivided; a single pseudobranch above these third maxillipeds. First pair of legs comparatively short and stout and provided with a "clasping organ" at the junction of propodos and carpos; a minute chela present partially concealed by a brush of bristles. Second pair of legs longer than the first, but shorter than the third pair; latter very long and slender, and both pairs with minute chelae as in the first. All three pairs with the full number of seven segments, but devoid of exopodite, epipodite, or gill. Fourth and fifth legs lacking, but in the male a pair of blunt protuberances immediately behind the third pair represent rudimentary fifth legs, for they carry the genital apertures. Four pleurobranchs present, three above the corresponding legs and the fourth one behind these. Petasma reduced; pars externa has no processus uncifer, pars astringens often absent, whilst pars media usually has only a capitulum and processus ventralis of simple form.

The males can be readily distinguished from the females by the slender elongate third peduncular segment of the antennule, the "clasping organ" formed by the modified outer flagellum of the same, the genital coxae (rudimentary fifth legs), the petasma between the first pleopods and the lamella present in some, if not all, cases at the base of the endopodite of the second pleopods.

DIVISION 2, BURKENROAD, 1934.

Epipodite of second maxilliped with podobranch. Rostrum with two denticles behind terminal point. Third joint of outer antennular flagellum of male with distally directed spine or spines. Coxae of female third legs with distomedian

Acetes australis, sp. nov.

Female (Fig. 1). The carapace is translucent and a little less than a quarter of the total length (35:8). The rostrum (Fig. 1*a*) is very similar to that of *A. indicus*, terminating in a sharp point behind which are two sharp denticles;

the anterior margin is very steep—almost at right angles to the body, and rather convex in outline. It does not project very far forwards.

Just in front of the rostrum between the bases of the eyestalks there is a vertical fleshy protuberance, of triangular shape and terminating in a blunt point; it is particularly well seen in lateral aspect projecting above the base of the eyestalk (Fig. 1, x).

Supraorbital and hepatic spines well developed; from the base of the latter a groove curves downwards and backwards for a short distance, finally becoming more or less horizontal; it terminates rather indistinctly near the posterior border of the carapace.

The eyestalks are long and slender and about one-third of the carapace length. They are conspicuously more slender than the cornea, which is of oval shape. In the figure of the female *Acetes* (Fig. 1) the eyestalks have been drawn a little foreshortened, so that their true length is not shown.

The antennules (Figs. 2 and 2*a*) have prominent statocysts which are easily visible toward the outer margin of the basal peduncular segment. The aperture of the statocyst is covered over by a thin transparent flap of cuticle that can be lifted with a fine dissecting needle. The basal peduncular segment is very flattened in a horizontal plane and somewhat hollowed out to fit the contour of the eyestalk, but it has a thick fleshy part (FL) which is vertical and which lies against its fellow at the proximal part of the inner edge of the segment. The outer margin of the segment has a deep indentation, which is flanked externally by a large tooth; a totally erroneous idea is obtained of the shape of this tooth by examination from the one aspect only, for when viewed from above it appears as in Fig. 2*a*, but if the antennule is held with the outer margin uppermost the tooth is seen to be a very broad flat lamella terminating in a sharp point. The basal peduncular segment is beset with strong bristles, of which there is a characteristic group of curved outline near the distal end. The second segment is the shortest of the three and cylindrical; it is about 2¼ times as long as broad. The slender third segment is about eight times as long as broad, and the proportions of the three segments are 22:7:16.

Of the two flagella, the inner one is by far the longer, being two-fifths of the body length; it has a thick proximal portion subdivided into about twenty-four very short segments, which are thickly beset with aesthetasks (AES). The whole structure is very prominent in both sexes. The outer flagellum is hardly longer than the third segment of the peduncle and consists of twenty-four short segments.

The antennae (Figs. 3, 3*a*–3*b*). The scale is three times as long as the peduncle and almost as long as the peduncle of the antennule (7:8). The outer margin is smooth and terminates in a sharp spine that projects beyond the anterior margin. The end and inner edge are clothed with long movable plumed bristles. The upper surface of the scale has a strong ridge that starts just distal to the base and is produced backwards as a stout bifid tooth (A, Fig. 3*a*), and standing opposite this is another tooth on the basal segment of the antenna (B, Fig. 3*a*). The basal segment has two other teeth (D and C), the former of which is long, curved and sharp. These teeth are best seen in side view.

The antennary flagellum is notable for its great length, being twice the length of the body (75:35), and it shows the remarkable flexion first described by

Kishinouye (1905) in *A. japonicus.* Fig. 3*b* shows the condition in *A. australis* and the description corresponds closely with that given by Kishinouye and also by Burkenroad (1934) for *A. carolinae.* The segments of the flagellum proximal to the flexion have short stiff hairs along one side and long paired setae along the other; the actual flexion is formed by six segments, which are naked except for a few short hairs, but the segments distal to the flexion are beset with strong plumed bristles which are arranged similarly to those of *A. carolinae.* On each segment is a pair of setae arched over toward one another to form a wide hollow cylinder and into this projects a short straight seta. This configuration is repeated on every segment distal to the flexion. Both Kemp (1917) and Boone (1935) are mistaken in saying that the flexion occurs in the flagellum of the antennule (in *A. indicus*).

The mouth is bounded in front by the labrum, at the sides by the mandibles and posteriorly by the "lower lip", which is bifid.

The labrum (Fig. 4) is roughly quadrangular in shape, with the two lower corners produced into a pair of "ears". It is very thick and fleshy, and the arrangement of the muscles suggests that it must be capable of a considerable degree of independent movement. On its anterior face it has long thin setae, whilst on the posterior (internal) face there is a conical elevation beset with powerful spines (SP.PR.).

The "lower lip" (Fig. 5) is a bifid structure, the halves of which are relatively much thinner than the labrum. They are heavily bristled along their inner edges, especially toward the base, and must constitute an efficient straining apparatus.

The mandible (Fig. 6) has a long three-jointed palp which is notable for the inconspicuousness of the first segment. The second segment is by far the longest, and, like the third, clothed with long plumed setae. The incisor region (IN, Fig. 6) consists of a single sharp tooth, the base of which continues around to the molar region (MOL) as a sharp serrated ridge. The latter terminates in another tooth, and the rest of the molar region is constituted by three short blunt teeth situated on the inner "grinding surface" of the appendage. The mandible is attached to the head by a long thin boat-shaped plate of chitin (INS), the base only of which is shown in the figure. This part is easily broken off and requires careful dissection.

The maxillules (Fig. 7), which lie immediately behind the lower lip, are each bilobed. The working surface of each lobe carries strong stiff bristles, some of which are spiny.

The maxillae (Fig. 8) are notable for the undivided protopodite (PROT), the inner edge of which is beset with closely placed bristles. The endopodite (RI) is small and undivided, and has near its base a small conical process (X) with short bristles. The exopodite (RE) is of typical form.

The first maxillipeds (Fig. 9) are decidedly jaw-like and have an epipodite (EP) but no gill. The two rami are flattened and heavily bristled. The exopodite (RE) has a short spiny projection on its inner margin.

The second maxillipeds (Fig. 10) are leg-like and have no exopodite. An epipodite (EP) with attached podobranch (POD) is present, and in this respect they are unique, for none of the other limbs carries a gill. The first three segments of the endopodite are all stout, but the carpos and dactylos are slender.

The third maxillipeds (Figs. 11 and 11*a*) are very long and slender, and have the full number of seven segments. They extend forward beyond the antennal scale by about the length of the dactylos. They are non-chelate and all the segments are heavily bristled.

The first legs (Figs. 12, 12*a*–12*b*) are relatively short and stout. There is a clasping organ (CL OR) formed by stout spiny bristles at the articulation of propodos and carpos; the group of bristles on the latter is distinctly U-shaped, whilst on the former they are in a straight line (Fig. 12*b*). The limb terminates in a minute but perfect chela which is partly concealed by a "Pinsel" of bristles, half of which are borne on the propodos and half by the dactylos ((Fig. 12*a*).

The second legs (Fig. 13) are much longer than the first, and extend as far forwards as the distal third of the antennal scale. Like the first and third pairs, they have minute chelae.

The third legs (Figs. 14 and 14*a*) are the longest of all and reach as far forwards as the end of the antennal scale. The distal inner margin of the coxa is produced into a strong blunt tooth, whilst the proximal part of the margin is expanded into a thin semi-transparent flap, on the anterior surface of which is the genital aperture. The basis terminates in a blunt projection (Fig. 15, BAS PR.), and not in a tooth as in *A. indicus*.

The female genital area (Fig. 15) is broadly similar to that of *A. indicus* as figured by Kemp (1917); the third thoracic sternite (ST III) has a wide shallow groove which is continuous with a still wider groove on the fourth sternite. On the third sternite there are two pairs of small rounded projections, one pair lying near the anterior margin, and the others behind these in contact with the thin coxal expansions (LAM) mentioned above. If the third leg be carefully dissected off, along with portion of the sternite, further features can be made out. On the inner side of the coxa there is a thick fleshy lamella (FL LAM, Fig. 15*a*) which is apparently the structure referred to by Burkenroad (1934) in his description of the genital area of *A. carolinae.* Immediately mesial to this lamella there is a very deep pocket, which is bounded posteriorly by the coxal expansion and the hinder sternal projection; the medial and anterior margins are formed by the sternum, whilst the lateral wall is overhung by the base of the fleshy lamella. In the floor of this pocket can be made out a still deeper cavity, which is presumably the sperm sac, although this feature was rather indefinite in all of the specimens examined. It was also found very difficult to see the actual position of the genital aperture. It may be mentioned in passing that the only way to get a really adequate picture of the female genital area is to examine it from all aspects; it is recommended that the third and fourth thoracic segments, with the third legs attached, be dissected away from the body as a unit, after which excess muscular tissue is removed and the whole structure cleared in glycerine. Light staining in borax carmine or chlorazol black is also helpful, as is the employment of various types of lighting during the examination.

In the female *Acetes* the fourth and fifth legs are waiting, but the male retains vestiges of the fifth pair.

The abdomen is 2·7 times the length of the cephalothorax and of typical sergestid form. The proportions of the segments are as follows 9:8:9:11:9:19, and each segment with the exception of the sixth has prominent pleura. The sixth pleurae are very much reduced, although quite visible as a pair of thin plates near the point of articulation of the uropods. The telson (Fig. 16) is as long as the fourth abdominal segment and devoid of any spines; it is fringed over its distal part with plumed movable setae and terminates in a point as in *A. indicus.*

The uropods (Fig. 1) are of typical form, and the outer margin of the exopodite has a proximal smooth region, which terminates distally in a tooth; the latter divides the margin in the proportion 60:43, the part distal to the tooth carrying the usual plumed setae.

The pleopods (Fig. 1). With the exception of the first pair these are all biramous; the first pair is uniramous. The protopodites decrease in length and increase in width from before backwards, those of the first pair being long and slender, whilst those of the fifth pair are short and stout. There is no large procurved tooth on the sternum between the first pair as in *A. indicus* and *A. erythraeus.*

The males are shorter and more slender than the females, their average length being in the vicinity of 22–25 cm. The sexual dimorphism is further indicated by the modified antennules, the genital coxae (vestigial fifth legs), the petasma between the first pleopods, and the modified endopodite of the second pleopods.

The antennule (Figs. 17, 17*a*–17*b*) has the typical three-jointed peduncle, the basal segment of which is shaped as in the female with the thick fleshy vertical part and the thin excavated horizontal portion. The statocyst is very prominent and the aperture as in the female covered by a thin flap of cuticle. The second peduncular segment is long compared with that of the female, whilst the third joint is very long and slender; this appears to be an almost constant character for the males of *Acetes.* The proportions of the peduncular segments are 3:2:3¾.

The outer flagellum is 11-segmented; the first two are unusually long as in *A. indicus.* The third joint has a long, curved, serrate, clasping spine (CL), and just near the base of this there is an accessory spine (AC.S) arising from the same segment, which overlaps a group of three on the following segment. The end of the clasping spine reaches almost as far as a group of four stout spines on the seventh segment. The segment carrying the group of three spines mentioned above also has an angular projection similar to that of *A. erythraeus* (PROJ), but this can be seen only if the antennule is carefully held in the right position with a dissecting needle. The inner flagellum is similar to that of the female in having a thickened proximal part which consists of about eighteen very short segments carrying aesthetasks; this thickened part is six-sevenths the length of the outer flagellum, whilst the whole of the inner flagellum is two-fifths the length of the body.

The genital coxae lie immediately behind the third legs, but are regarded as vestigial fifth legs because they carry the genital apertures. Each one is a sharp conical projection with the anterior surface slightly indented.

The petasma (Fig. 18) is of the typical simplified *Acetes* form with three primary divisions, viz., pars externa (P.EX), pars media (P.M.) and pars astringens (P.AS.). Pars externa is a broad flat plate with the distal part of the outer margin notably thickened. Pars astringens is a thin membrane folded upon itself and carrying a row of fine coupling hooks that interlock with corresponding hooks on the other half of the petasma. The outer proximal corner of pars media is produced, whilst distally it divides into capitulum (CAP) and processus ventralis (PV.). The latter is pointed and devoid of spines, whilst the former has a single large falcate spine (F.SP.), which in some specimens projects beyond the margin and in others is very difficult to see because it may partially invaginate into the cuticle. The distal part of the capitulum has a warty appearance due to the presence of fine invaginated spines.

The second pleopods (Figs. 19–19*a*) have the endopodite slightly modified in that the latter has at its base a flat lamella (RI LAM), the distal edge of which has four or five curved short hooks. This feature is not found in the females.

The remaining appendages are similar to those of the female. The very long antennary flagellum, which is twice as long as the body, shows the characteristic flexure at about a quarter of its length from the base. The mouth parts, maxillipeds, and legs agree closely, even to the presence of a strong tooth on the distal inner margin of the coxa of the third legs. The telson is also quite similar in both sexes and like that of *A. indicus.*

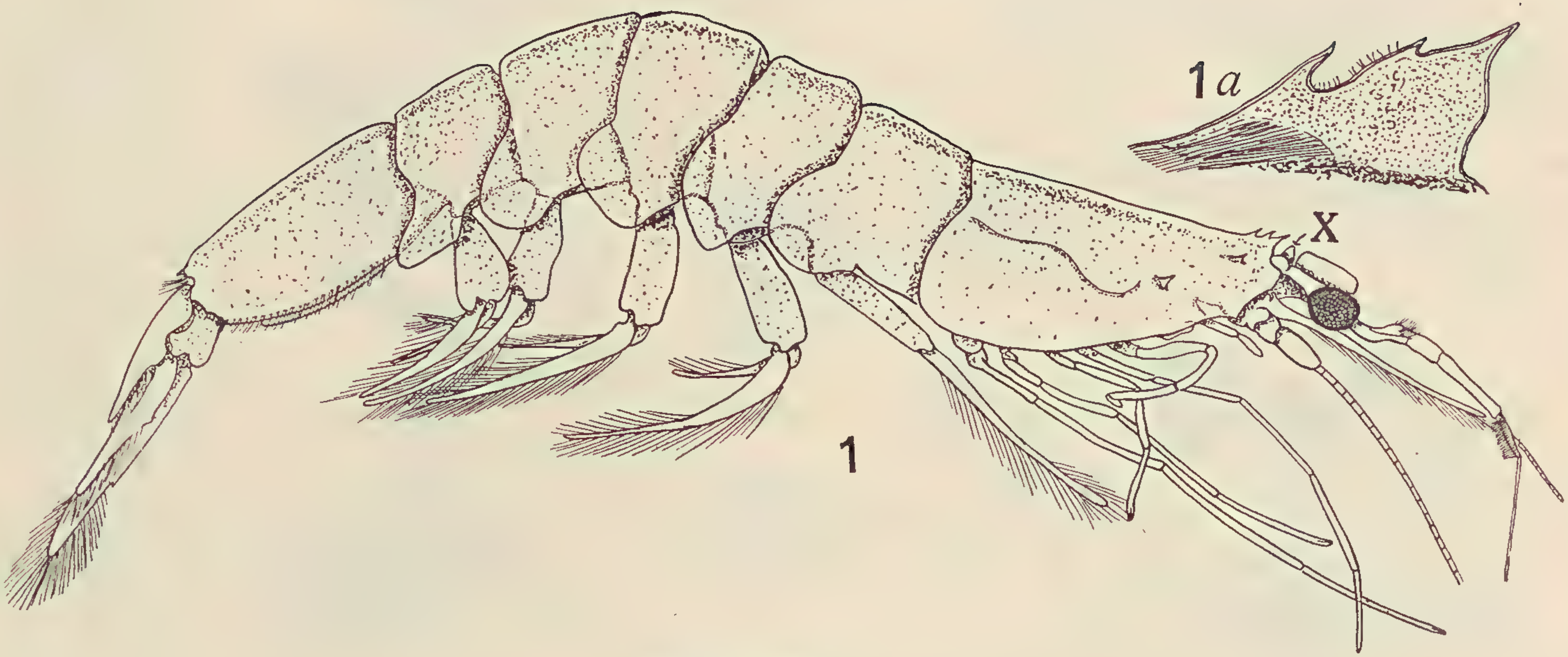
Gills. The branchial formula for *A. australis* is the same as that given by Kemp (1917) for the species, which are described in his paper and is set forth below.

	vii	viii	ix	x	xi	xii	xiii	xiv
Podobranchiae	ep.	I ep.	—	—	—	—	—	—
Arthrobranchiae	—	—	—	—	—	—	—	—
Pleurobranchiae	—	—	I	I	I	I	I	—

It will be noticed that five pleurobranchs are present, although Hansen (1919) in his generic diagnosis states that four is the typical number.

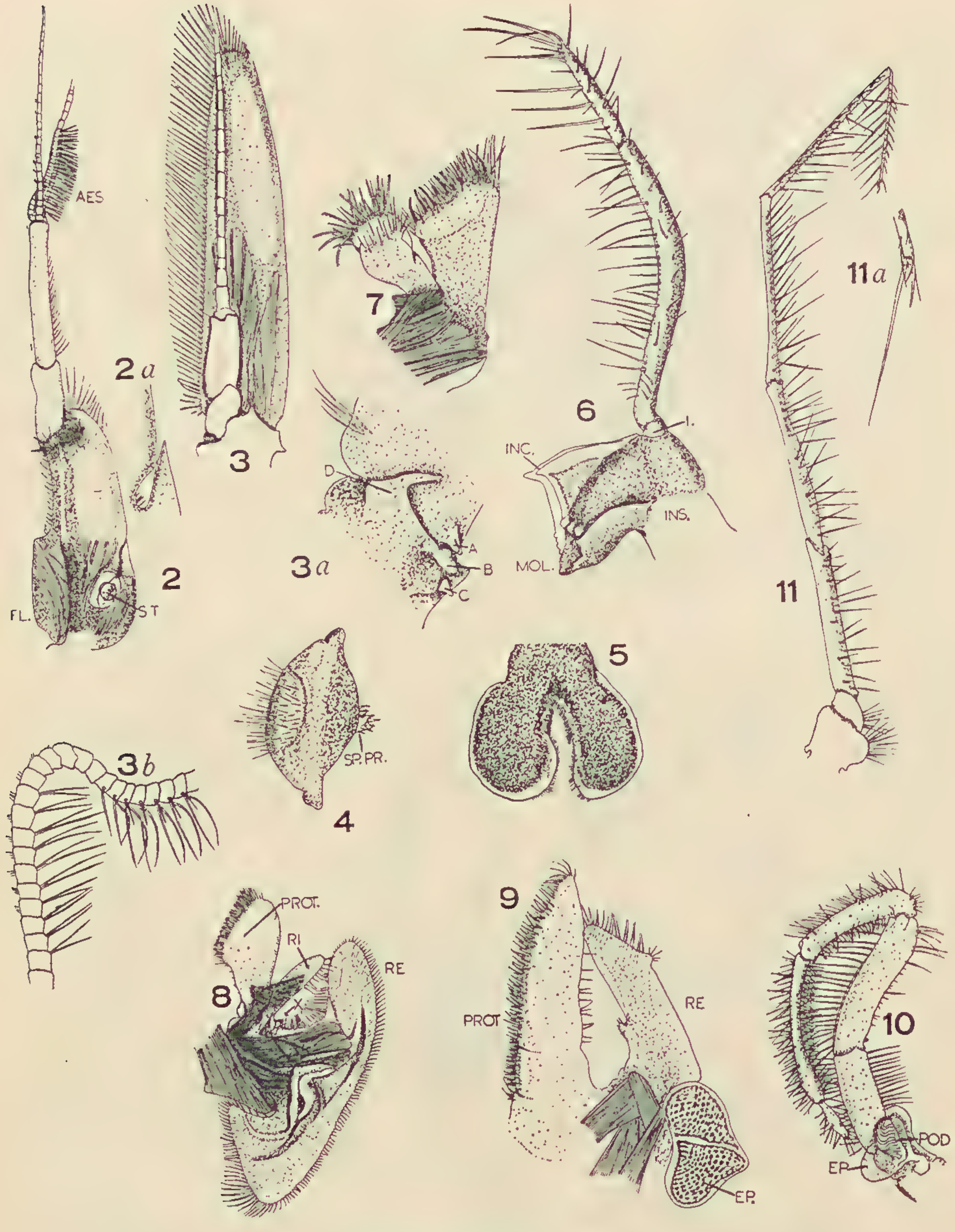
Affinities. The present species shows close affinities with the Asiatic species, and of these it comes closest to *A. erythraeus* and *A. indicus.* The female genital area is very like that of *indicus*, but the basis of the third legs terminates at its distal margin in a blunt projection and not in a sharp tooth; furthermore, there are differences in the respective thoracic sternites.

The petasma is extraordinarily like that of *erythraeus*, with the exception of the capitulum with its single falcate spine; in every other detail it agrees closely. The male antennule of *australis* is, however, quite distinctive, with its accessory spine near the main clasping spine, and the group of three spines together with the angular projection on the segment following the one which carries the clasping spine. A further important difference lies in the fact that *australis* lacks the large procurved spine that occurs between the first pleopods in both *indicus* and *erythraeus.*



Acetes australis, sp. nov.

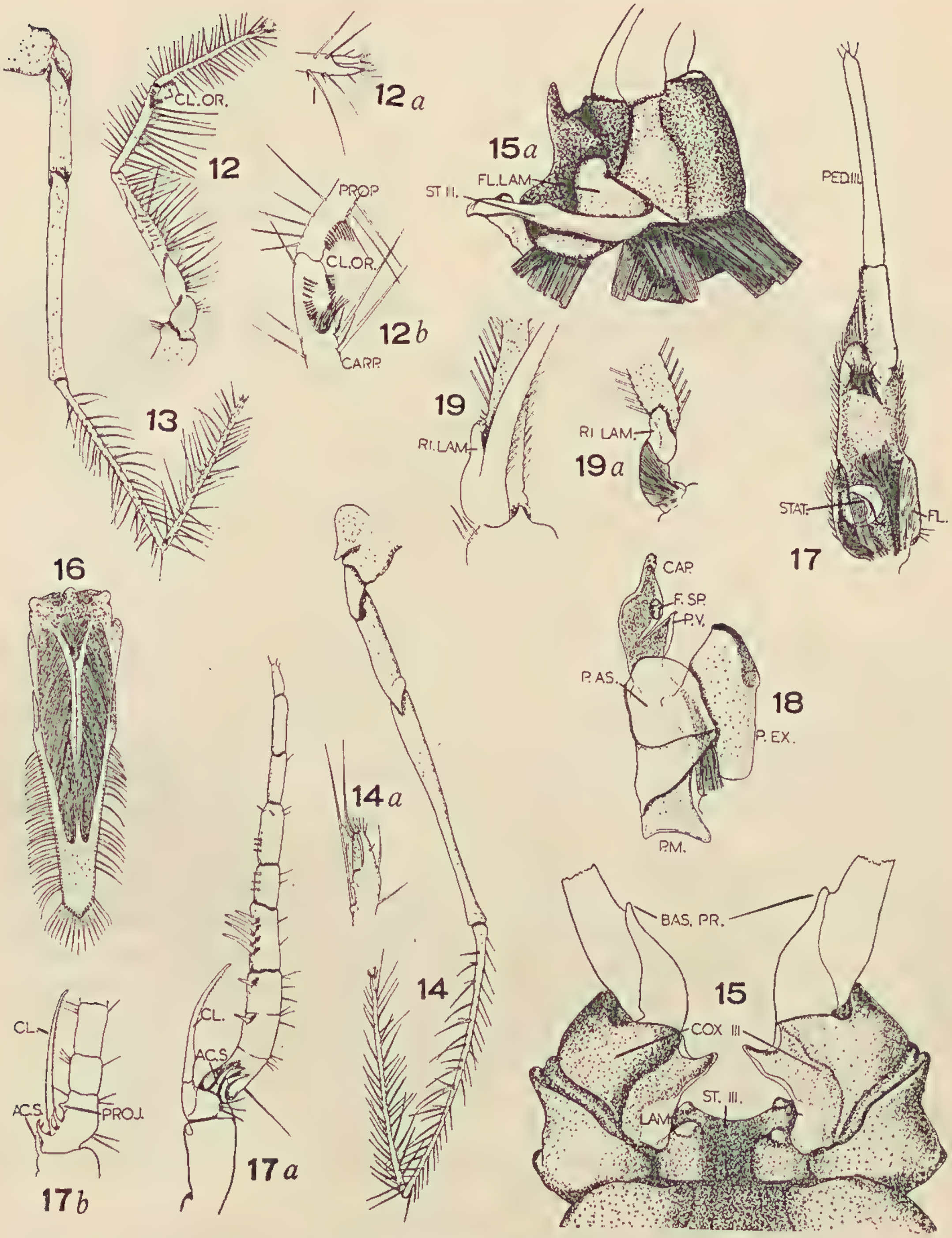
Figs. 1-1*a*.—1 : 34 mm. female, lateral view ; X, fleshy projection in front of rostrum. 1*a* : Rostrum.
A.N.C., del.



Acetes australis, sp. nov.

Figs. 2-11*a*.—1 : Female antennule ; FL., vertical fleshy part ; ST, statocyst ; AES, aesthetasks. 2*a* : Lateral tooth of antennule. 3 : Antenna. 3*a* : Base of scale of antenna ; A, B, C, D, see text. 3*b* : Region of flexure in antennal flagellum. 4 : "Upper lip", seen from below ; SP.PR., spinous projection. 5 : "Lower lip", anterior view. 6 : Mandible ; I., first segment of palp ; INC., incisor region ; MOL., molar region ; INS., base of chitinous insertion. 7 : Maxillule. 8 : Maxilla ; PROT., protopodite ; RE, expodite ; RI, endopodite ; X, projection at base of endopodite. 9 : First maxilliped ; PROT, protopodite ; RE, exopodite ; EP., epipodite. 10 : Second maxilliped ; EP, epipodite ; POD, podobranch. 11 : Third maxilliped. 11*a* : End of dactylos of same.

A.N.C., del.



Acetes australis, sp. nov.

Figs. 12-19*b*.—12: First leg; CL.OR., clasping organ. 12*a*: Chela of same. 12*b*: Clasping organ enlarged; CL.OR., clasping organ; CARP., carpos; DACT., dactylos. 13: Second leg. 14: Third leg. 14*a*: Chela of same. 15: Genital area; COX III, coxa of third leg; BAS.PR., projection on basis; ST.III., third thoracic sternite; LAM, coxal expansion. 15*a*: Inner aspect of coxa of third leg; ST III., third thoracic sternite; FL.LAM., fleshy coxal lamella. 16: Telson; 17: 22 mm. male antennule; STAT., statocyst; FL. vertical fleshy portion; PED.III., third peduncular segment. 17*a*: Outer flagellum of same; CL., clasping spine; AC.S., accessory spine. 17*b*: Another view of base of same; PROJ., projection. 18: Petasma, right half; P.AS., pars astringens; P.EX., pars externa; P.M., pars media; CAP., capitulum; F.SP., falcate spine; P.V., processus ventralis. 19: Base of second pleopod; RI.LAM., lamella at base of endopodite. 19*a*: Another view of the lamella.

A.N.C., del.

FURTHER NOTES ON THE LIFE HISTORY OF THE KING PRAWN, *PENAEUS PLEBEJUS* HESSE.

By

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(Figures 1–15.)

In a paper (Dakin, 1938) on the larval and post-larval development of this common Penaeid prawn of the coast of New South Wales, the first account was given of the habits and life history of a very well known inhabitant of certain of our estuaries and coastal lagoons. At the time this research was first undertaken there was much to be done before it could even be certain that these New South Wales prawns spawned at sea. In fact, the discovery of the breeding place and general life history was the main object of the work. Remarkably little was then known of the life history of the Penaeids. It turned out that, working at the same time, the United States Bureau of Fisheries was following the life history of the common American form, *Penaeus setiferus* (Linn.), on a relatively large scale, whilst Madame Heldt had been working for upwards of six years in the Mediterranean at Salammbo (Tunisia) on *Penaeus trisulcatus* Leach, and four other Penaeid genera. Heldt's excellent and very comprehensive paper was published in October 1938, and last year (1939) the result of the American work was indicated in a paper by J. C. Pearson.

The life history of the Penaeid prawns has thus quite suddenly been very considerably elucidated.

Both Heldt and Pearson were able to work from eggs and larvae reared in the aquarium.

Unfortunately, by reason of the marine conditions prevailing off Sydney, where we have been compelled to work under oceanic conditions with a small boat and lack of many facilities, we have only been able to obtain a relatively small number of the earlier stages and these, when isolated, were in no condition for culture experiments. The different stages had to be isolated from preserved plankton catches. This eventually led to a more concentrated effort on the high seas with nets which could be drawn (with sledge attachment) just above the sea bottom. More material was obtained, but the beautifully certain method of culture has not been possible.

The most valuable part of the earlier paper which elucidated the general life cycle of the most important commercial species of this coast, was the series of post-mysis stages, and it was pleasing to find confirmation of the change of form of the telson, described for the first time in that paper, by comparison with the discoveries of Heldt. One or two gaps were, however, left in our early series.

Now, as a result of extended cruises, we have obtained additional material which has indicated the necessity for correcting some of the sequences.

Reference to that first description will indicate that the *post-mysis* series commenced with a small larva 3·5 mm. in length, having only two rostral teeth. The next stage possessed 4 rostral teeth and it was pointed out that at least one intermediate stage was missing. The discovery of a 3-rostral teeth stage and two new forms in the mysis and post-mysis stages have now necessitated the discarding of the mysis and first post-mysis stages then figured. Further experience shows that these forms belong to one of the other Penaeid species, the possibility of whose presence was always before us.

A description of this new post-mysis stage will first be given, and then it will be indicated how this discovery influences the matter of the earlier stages. In short, we shall work back to the earlier stages from the 3-rostral teeth post-mysis stage II. The structure of the appendages and general form of this stage show a clear resemblance to the 4-rostral teeth stage which follows it (see Dakin, 1938). The size, 6·6 mm., fits in the series.

The telson bears the armature of spines indicated in the figure (Fig. 5), namely, three definitely lateral spines on each side with ten terminal spines, the two outside ones being large like the lateral spines (to which series they might be included). This form agrees with that of Heldt for a corresponding stage in *Penaeus trisulcatus*.

The antennule (Fig. 6) has the two rami, one with four and the other with three segments. In the following 4-rostral teeth stage (*loc. cit.*, fig. 40) these segments are five and four in number.

The endopodite of the antenna (Fig. 7) is practically as long as the scale.

The mandible (Fig. 8) and the maxillule (Fig. 9) are practically as in the 4-teeth stage, with a few less setae. Incidentally this also agrees very closely with Heldt's figures for the Mediterranean species at this stage.

The other significant appendages are figured (Figs. 10–15). Two median ventral spines are well developed, one on each of the last 2 segments of the thorax (sternites XIII and XIV), but, as Burkenroad has indicated, these spines are present in other species and thus not necessarily of specific importance.[1]

At this stage the rostrum extends as far forward as the eye. This form appears to correspond with Heldt's stage VI after the protozoeal stages.

The discovery of this 3-rostral teeth stage made it clear that the 2-rostral teeth stage previously figured (*loc. cit.*, fig. 39) was that of another species. In

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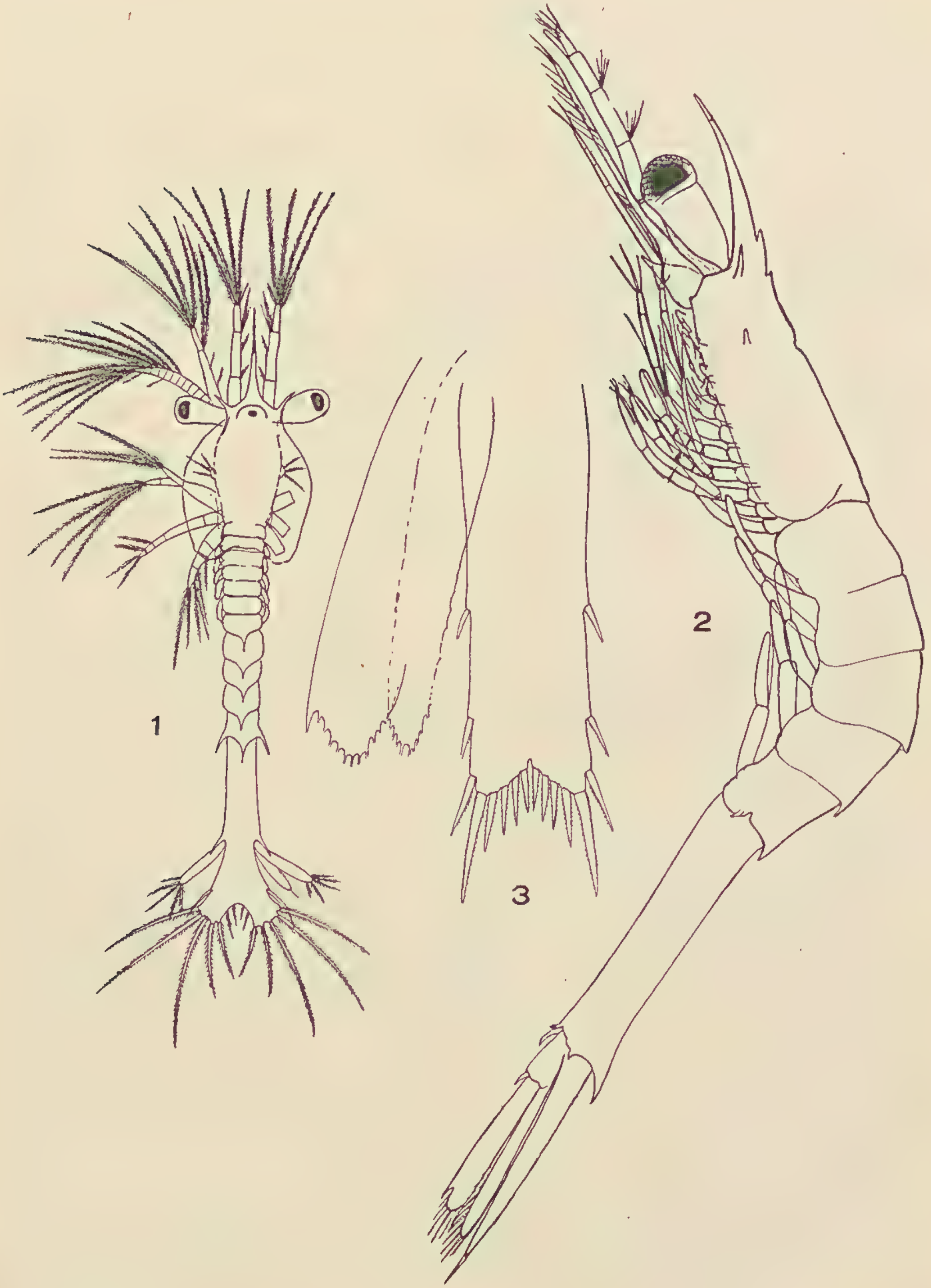
[1] It may be noted here that whilst these two ventral spines are found in the very smallest adults of *Penaeus plebejus*, they are absent in the small corresponding stages of our other common Penaeid, *Metapenaeus macleayi*. It was because of this distinct difference that special note was taken of these spines in the post-larval stages. It is, however, impossible as yet to indicate the condition in the earlier developmental stages of *M. macleayi.*



Figs. 1-3.—1. 3rd protozoeal stage. 2. Mysis, stage III. 3. Telson of mysis, stage III.

the first place the size is against the latter, and in the second place the armature of the telson altogether puts it out of court now that we have the additional information. It is easy to see this now, but it must be confessed that, with no other work for comparison, the fact that only one type of the later 4- and 5-rostral teeth stages occurred commonly in our catches at one and the same locality resulted in a mistaken identity here.

The stage preceding that just described has also 3 rostral teeth—in other words, the first *post-mysis* stage has 3 teeth (*cf.* Heldt's stage V), the last mysis (stage IV) has 2 rostral teeth.

The telson of the first *post-mysis* stage is figured (Fig. 4). It will be noticed that it shows a slight cleft indicating the original furca, and the number of setae is significant.

The Mysis Stages.

In the original paper we described one mysis stage. It was always found in company with the succeeding post-mysis stage. Unfortunately, as noted above, this stage has now had to be eliminated from the *P. plebejus* series. The result is that the mysis stage must also go. The two stages were obviously linked.

At the same time, the discovery of other larvae, coupled with information from the two life histories recently made known, has thrown an altogether new light on certain features of this stage.

In the first post-mysis stage of Penaeus the total number of spines on the telson is 16. In the earliest protozoeal stage known in the life history of *any* Penaeid the number of setae is 7 on each furca. This number is even found on the last nauplius stage. Somewhere in the following stages of Penaeus this number must be increased by two. There was nothing to indicate at the beginning that features which may be characteristic of different genera in this respect might be established already in the protozoeal stages. Now, however, we may possibly assume that in the genus Penaeus (as restricted by Burkenroad) a characteristic 16-spined telson is always found not only in the *mysis* stages, but in the late *protozoea* also.

Heldt found by culture experiments that there were four mysis stages in her Mediterranean species. Pearson, with the American *Penaeus setiferus*, refers only to two mysis stages.

We have only taken one of these stages which we are inclined by reason of the telson armature and a comparison of other details to regard as *Penaeus plebejus*. The whole animal, together with a dorsal view of the telson, is figured (Figs. 2 and 3). The size is 5·7 mm. There are 2 rostral teeth. A well developed supraorbital spine is present. The armature of the 5th and 6th abdominal segments should also be noted. This mysis stage figured comes near to the last two mysis stages of Heldt. In Heldt's experiments each stage is a little more advanced than the other, and the fourth stage differs from the third in the presence of setae on the pleopods. Pearson also seems to get setae on a mysis stage, but it is difficult to make comparison here for possibly some stages may be still missing in this American life history. On the whole, then, it will be suggested, failing culture experiments, that the mysis now figured is a late mysis comparable to Heldt's stage III, and that there is probably a fourth mysis stage.

The Protozoeal Stages.

It has been indicated that in most text books the known protozoea of Penaeids are figured with only seven feathered setae on each furcal branch of the telson. A protozoeal stage with 8 setae had, however, turned up in our catches which was a much more likely stage in the life of *Penaeus plebejus*, especially in the light of our latest discoveries, and then Heldt's work showed that the 8-setae stage occurred also in her Penaeus species. We now have three protozoeal stages with 2 × 7 setae on the telson and two types with 2 × 8 setae. It is one of these latter types which must be linked with *Penaeus plebejus*. We hope to follow out the series of the 2 × 7 setae type in the near future. The new protozoea (3rd stage) is figured (Fig. 1). We have a first protozoeal stage (not figured as yet), but owing to the absence of the second we are not inclined to affirm that it is one species or another.

In conclusion, it must be stated that in the absence of definite cultures there is always the possibility of confusion in these earlier stages where a complete series is not available. In this respect, too, I should like to refer to a communication already made to Dr. Burkenroad in regard to the occurrence of eggs containing nauplii off this coast. They were at first attributed to *Penaeus plebejus*. We now consider from the difficulty of finding the earliest larvae of this form that it is most likely those eggs did not belong to it. There seems no doubt whatever that the eggs of this species are normally demersal, falling to the sea bottom if not actually deposited there. It is, of course, not beyond the bounds of possibility (where there are strong upwards currents or other suitably disturbed conditions) for some to be carried to higher levels. Incidentally, it may be interesting to add that Heldt records a single female of the Mediterranean species as depositing 800,000 eggs. Furthermore, in view of the theories which have been suggested regarding the later life of these egg-laying females, the individual seemed in no way indisposed afterwards.

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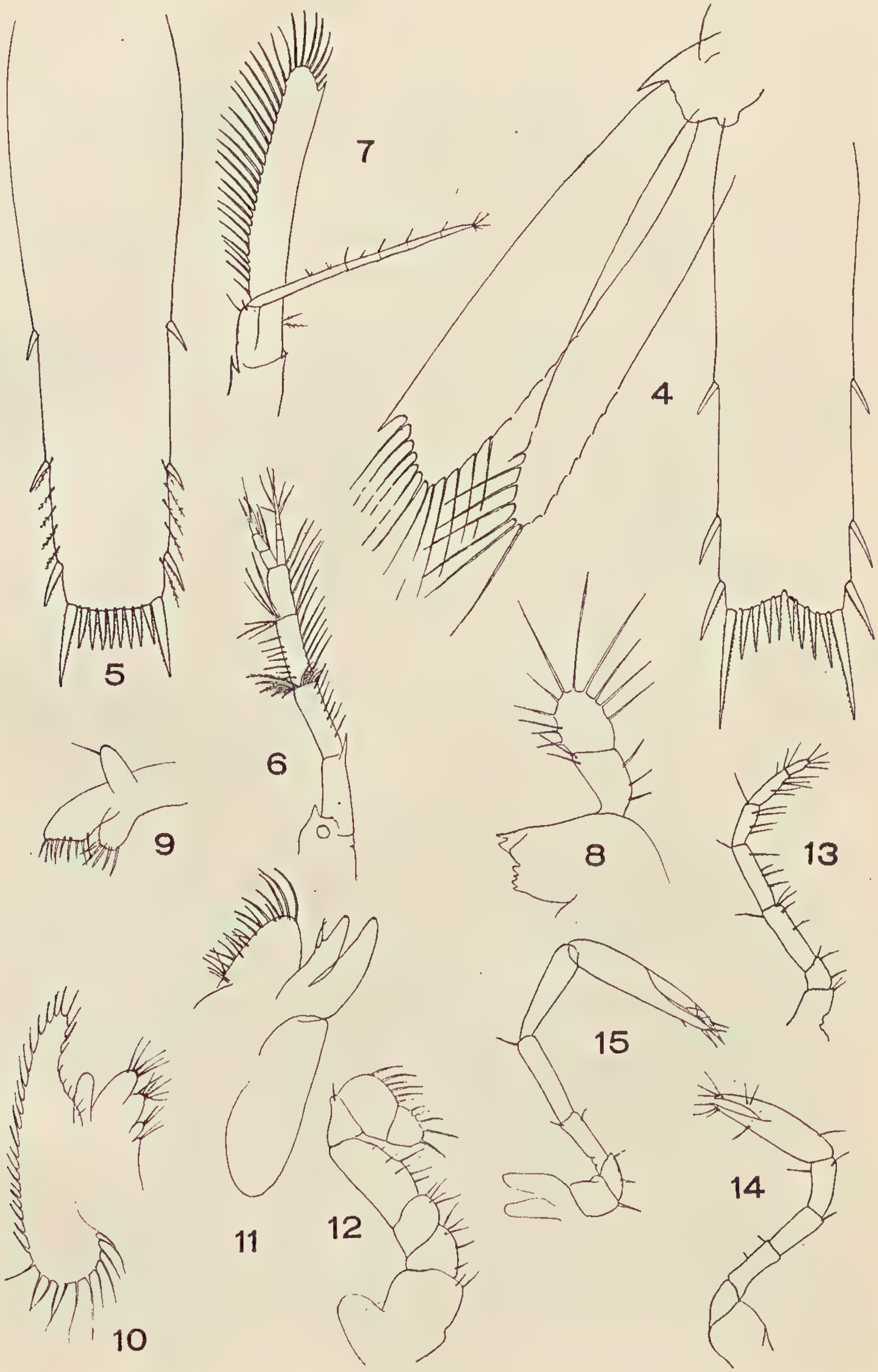
Fig. 4-15.—4. Telson of first post-mysis (stage V), 3 rostral teeth. 5. Telson of second post-mysis (stage VI), 3 rostral teeth. 6. Antennule of second post-mysis. 7. Antenna of second post-mysis. 8. Mandible of second post-mysis. 9. Maxillule of second post-mysis. 10. Maxilla of second post-mysis. 11. 1st maxillipede of second post-mysis. 12. 2nd maxillipede of second post-mysis. 13. 3rd maxillipede of second post-mysis. 14. 1st peraeopod of second post-mysis. 15. 2nd peraeopod of second post-mysis.



ON A COLLECTION OF NEMATODES FROM AUSTRALIAN MARSUPIALS.

By

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(Figures 1–12.)

A small collection of parasitic nematodes belonging to the Australian Museum was submitted to us by the Director, Dr. C. Anderson, for examination, those from marsupials being dealt with here. The host names, Museum registered number, locality and species recorded in this paper are as follows:

Macropus major Shaw (W.3212), probably from N.S.W.; *Zoniolaimus bipapillosus* J. & M.; (W.3213) *Pharyngostrongylus macropodis* Yorke and Maplestone.

Macropus ocydromus Gould, (W.886), from near Cranbrook, south-western Australia: *Pharyngostrongylus beta* J. & M.; *Cloacina curta* J. & M.; *C. obtusa* J. & M.

Macropus sp., probably *major* Shaw, (W.370), from Eidsvold, Queensland: *Dipetalonema roemeri* (Linstow).

Macropus rufus Desm., (W.1072), from Mt. Lyndhurst, Northern Flinders Range, South Australia: *Pharyngostrongylus beta* J. & M.

Macropus rufus Desm., (G.11181), no locality mentioned: *Zoniolaimus longispicularis* (Wood).

Macropus fuliginosus Desm., (W.1064), from Deep Creek, near Kingscote, Kangaroo Island: *Zoniolaimus communis* J. & M.

Macropus robustus Gould (W.3214), from Armidale, N.S.W.; *Zoniolaimus longispicularis* (Wood).

Thylogale eugenii Desm., (W.1069), from Deep Creek, near Kingscote, Kangaroo Island: *Zoniolaimus eugenii*, n. sp.; *Cloacina petrogale* J. & M.; *Physaloptera* sp.

Thylogale thetis Lesson (W.3173), Huonbrook, near Mullumbimby, N.S.W.; *Zoniolaimus uncinatus* J. & M.

Wallabia irma Jourdan, (W.887), near Cranbrook, south-western Australia: *Macropostrongylus irma*, n. sp.; *Pharyngostrongylus beta* J. & M.; *Zoniolaimus communis* J. & M.; *Cloacina curta* J. & M.

Wallabia sp. "wallaby", (G.11103), without locality: *Dipetalonema* sp.

Wallabia sp. "wallaby", (G.11113), without locality: *Contracaecum erraticum*, n. sp.

Collections W.886, 887, 1064 and 1072 were made in 1921 by E. Le G. Troughton, Museum Mammalogist, Australian Museum. G.11103, 11113 and 11181 formed part of collections obtained long ago and have no names of localities associated with them. They must have been made about seventy years ago, as the labels are all in the handwriting of G. Krefft, who was Curator of the Australian Museum and read a paper before the Entomological Society of N. S. Wales in 1871 (published in 1873) on Australian Entozoa. In addition to describing a number of cestodes, mostly from Australian birds and marsupials, he recorded under broad generic names, e.g. *Ascaris*, *Distoma*, etc., the presence of helminths in various animals, chiefly birds and reptiles. The material was stated to have been collected by himself and by Mr. George Masters in the neighbourhood of Sydney and in Queensland. Since all the specimens recorded as obtained by Masters are stated to be from Queensland, presumably Krefft secured the New South Wales material and Masters that from the northern state. Some of it must have come from the Burnett River district of Queensland, e.g. *Ascaris* sp. (which we can safely attribute to *Amblyonema terdentatum* Linstow) from *Ceratodus forsteri*, and perhaps material from *Elseya dentata* (a tortoise) and from "northern wallabies" (*Halmaturus*), Krefft actually naming *Halmaturus mastersi* (now known as *Wallabia bicolor* var. *mastersi*; syn. var. *ingrami* Thomas) from that region, his *Taenia mastersi* probably coming from the same host. *Ascaris* sp. was recorded (Krefft, 1873, 212) from a bandicoot, *Perameles nasuta*, a species formerly common in the Sydney district, which was probably the locality for Krefft's material, his parasite belonging without doubt to our *Physaloptera peramelis* (also from the vicinity of Sydney), but his specimens are no longer available for comparison. Collection G.11113, labelled "Ascaris from Wallaby", but without any other data, contains only a species of *Contracaecum*, an occurrence so striking as to suggest an error in labelling, as we indicate in a later portion of this paper. Regarding G.11181 from *Macropus rufus*, the host animal must have been taken somewhere on the great inland plains and we are not able to suggest any more definite locality for these particular parasites, though the species, *Zoniolaimus longispicularis*, has been recorded by us from many kangaroos and wallabies from various parts of Australia. An account of several of Krefft's cestodes was published by one of us (T.H.J.) in 1912.

Contracaecum erraticum, n. sp.

(Figs. 1–2.)

G.11113: "Ascaris from wallaby."

Males about 16–17 mm.; females 15–30 mm. long. A collar region behind the lips, 45μ deep. Lips large, each with a pair of laterally-projecting horns; interlabia nearly as long as the main lips; each sublateral lip with one, and the dorsal lip with two large rounded papillae.

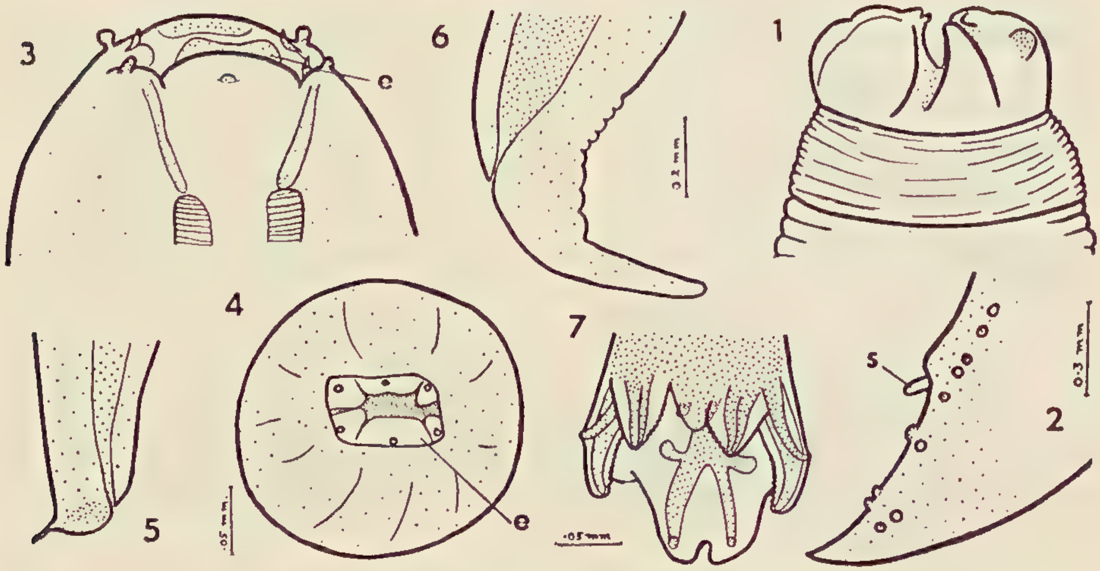
In a male 16·5 mm. long the oesophagus was 2·25 mm, the stout conical intestinal caecum 1·65 mm., and the thin, club-shaped oesophageal diverticulum 0·55 mm. long. In the same male the spicules were 3·8 mm. long, i.e. 1:4·3 of body length; but in others they ranged to 1:5·5 of body length. There were twelve pairs of preanal papillae arranged in two linear rows, with the larger papillae more anteriorly situated. Postanally were six pairs of papillae, those of each side being arranged in three groups of two each, one group just posterior to the anus, another near the mid-line behind these and one laterally.

In some females the cuticle just behind the collar formed a ridge. The position of the vulva was 1:3·6 of body length from anterior end. The conical tail was 0·3 mm. long.

The form of the head and the number and arrangement of the postanal papillae suggest *C. microcephalum* (Rud.), but there are fewer preanal papillae and a shorter oesophageal appendix than in Rudolphi's species; the spicule length given by Cram is not referred to any particular length given for the males.

In general features it also resembles *C. punctatum* Gedoelst, but differs in having fewer preanal papillae, and slightly shorter oesophageal appendix; the ratio of spicule to body length is evidently extremely variable in *C. punctatum*.

The worms are shorter than *C. spiculigerum* (Rud.); the ratio of the lengths of oesophageal and intestinal caeca is different; there are only two pairs of lateral postanal papillae instead of three pairs; and only twelve pairs of preanal papillae instead of 38–56 pairs mentioned by Cram as occurring in *C. spiculigerum*; while the spicules are slightly longer relative to body length than in Rudolphi's species. *C. rodhaini* (Gedoelst), from *Plotus rufus*, is about the same size, but the number of pre- and postanal papillae in the male is greater. *C. tricuspe* (Gedoelst) from *Ardea* sp. and *Plotus melanogaster*, is a shorter species, with relatively longer oesophagus and spicules, many more preanal papillae, and has a more posteriorly situated vulva. *C. pseudodontum* Kreis, from *Phalacrocorax*, agrees very closely with *C. erraticum*, differing in having relatively shorter oesophageal appendix, shorter spicules, and many more preanal and one pair fewer postanal papillae in male, and in the presence of a tooth in the mouth.



Figs. 1-2.—*Contracaecum erraticum*, n. sp.: 1, head; 2, tail of male. Figs. 3-6.—*Macropostrongylus irma*, n. sp.: 3, lateral view of head; 4, anterior view of head; 5, posterior end of female; 6, variant type of female tail. Fig. 7.—*Pharyngostrongylus beta*: bursa. Figs. 1, 3 and 7 to same scale; figs. 5 and 6. e, element of leaf crown; s, spicule.

In view of the fact that the known hosts for the adult stage of species of *Contracaecum* are fish-eating vertebrates, it seems most probable that a mistake in labelling or a wrong transference of labels has occurred. Krefft's original list (1873, 212–14) contains no mention of "*Ascaris*" from a wallaby, but does include *Ascaris* sp. from *Plotus novaehollandiae*, a bird from which *Contracaecum spiculigerum* has been reported. Our studies suggest that the latter may be a composite of some closely related species. A search has failed to reveal the presence of

Krefft's material from *Plotus*, unless, as is quite probable, his label "*Ascaris* from Wallaby" should read "*Ascaris* from *Plotus novaehollandiae*".

Krefft's specimens of *Ascaris* sp. (1873, 212) from *Delphinus forsteri* from Port Jackson appear to have been lost, but our species does not resemble the Anisakine nematodes recorded from fish-eating mammals.

Macropostrongylus irma, n. sp.

(Figs. 3–6.)

Part of collection W.887 from the stomach of *Wallabia irma* Jourdan from the vicinity of Cranbrook, south-western Australia. The species is represented by six immature females, some of them poorly preserved. We assign it to *Macropostrongylus* on account of the characters of the head.

Length 14–16 mm. Anterior end rounded; six small circumoral papillae; buccal capsule stout-walled, about 70–80μ wide, 50–70μ deep; from its anterior border a leaf crown of six elements, each recurved outwardly, the two lateral elements being wider than the four submedian. Six low lips, laterals wider than submedians; lateral papillae much smaller than submedian. Oesophagus 1·65 mm. long, widening towards its posterior end. Nerve ring at 0·85 mm., and excretory pore at 1·1 mm., from the anterior end. A mass of granular tissue just behind the anus. Tail about 0·2 mm. long, with short narrow terminal portion dorsally directed and ending in a point. Vulva not seen.

With these worms were found three females possibly of the same species, but differing somewhat. Two of these, while having a head of the type described above, had the tail longer, more gradually tapering and without the mass of granular tissue posterior to the anus. The third had a tail like the other two, but there was a slight variation in the head region, where a circular constriction just behind the lips gave it a different appearance. These variations may have been due to differences in shrinkage during preservation.

The species differs from others in the characters of the lips and leaf crown, and in the shape of the tail.

Pharyngostrongylus macropodis Yorke & Maplestone, 1926.

From *Macropus major*, locality not stated, probably N.S.W. (W.3213).

Pharyngostrongylus beta Johnston & Mawson, 1938.

(Fig. 7.)

This species was represented in collections W.886 from *Macropus ocydromus* from Cranbrook, Western Australia; W.1072 from *M. rufus* from Mount Lyndhurst, South Australia; and W.887 from *Wallabia irma*, Cranbrook, Western Australia.

The specimens recorded here differ slightly from the type described from Central Australia and from those found in Eastern Australia. They have a slightly longer vestibule and the bristles on the oral papillae are bifid. Such variations do not seem to justify the erection of a new species. The variant has also been identified by us from material collected from *Thylogale flindersi* (Flinders Island, South Australia) and *Petrogale pearsoni* (Pearson Island, South Australia). A better figure of the bursa than that given previously by us (J. & M., 1938*b*, 265, fig. 6) is included in this report.

Zoniolaimus communis Johnston & Mawson, 1939.

The Museum collection contains specimens from *Macropus fuliginosus*, Kangaroo Island (W.1064), and *Wallabia irma*, Cranbrook, Western Australia (W.887). The species was described from Queensland material, its known range being now greatly extended.

Zoniolaimus eugenii, n. sp.

(Figs. 8–12.)

From *Thylogale eugenii*, Deep Creek, Kangaroo Island (W.1069).

Stout worms; male about 16–20 mm., females 25–30 mm. long. Head with six lips; two laterals squarish, each with small median papilla near top; four submedians slightly bifid at end, and bearing near base each a small papilla with bristle. The species is characterized by having a pair of accessory lobes arising from the base of each submedian lip. Buccal capsule about 0·09 mm. in diameter, 0·07 mm. deep, with walls about 15μ thick, with base 0·13 mm. from top of lips. Oesophagus 2·15 mm. long, and consisting of an anterior narrower portion 0·8 mm. long, widening suddenly to about twice the diameter, but becoming constricted just before joining the intestine. Nerve ring surrounding oesophageal constriction; excretory pore at same level.

Male.—Bursa large; ventral lobes not united, dorsal lobe bifurcate and much longer than rest of bursa. Ventral rays stout, parallel, extending nearly to bursal edge; externo-lateral and externo-dorsal arising with laterals and not reaching edge of bursa. Laterals cleft for most of their length; longer than externo-lateral; not quite reaching edge of bursa. Dorsal ray stout, bifurcating at mid-length, each branch giving off a short lateral ray before proceeding nearly to bursal edge. Spicules 2·5 mm. long, 1:6·4 of body length.

Female.—Body tapering to a fine point; tail 1·5 mm. long, sometimes dorsally directed. Vulva 0·6 mm. in front of anus; vagina 0·4 mm. long; ovejectors about 0·8 mm.; eggs 0·1 by 0·06 mm.

This species differs from other members of the genus in the presence of paired accessory lobes on the submedian lips.

Zoniolaimus longispicularis (Wood) Johnston & Mawson, 1938.

From *Macropus rufus*, locality ?, G.11181, many specimens; from *M. robustus*, Armidale (W.3214). This species is now known to have a wide distribution in the drier parts of Australia.

Zoniolaimus bipapillosus J. & M., 1939.

From *Macropus major*, locality not stated, probably N.S.W. (W.3212).

Zoniolaimus uncinatus J. & M., 1939.

From *Thylogale thetis*, Huonbrook, near Mullumbimby, N.S.W. (W.3173).

Cloacina curta Johnston & Mawson, 1938.

From *Macropus ocydromus* (W.886), and *Wallabia irma* (W.887) from Cranbrook, Western Australia.

Cloacina obtusa Johnston & Mawson, 1939.

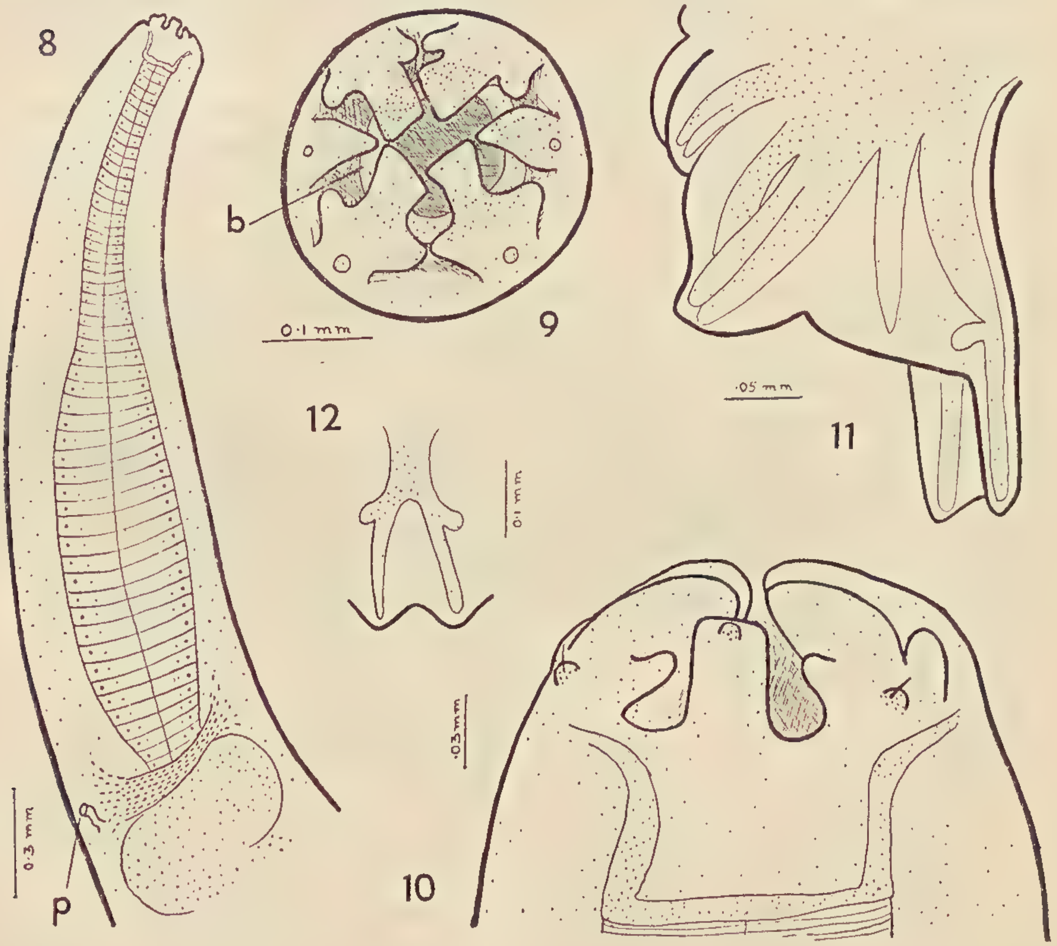
From *Macropus ocydromus*, Cranbrook, Western Australia (W.886).

Cloacina petrogale Johnston & Mawson, 1938.

A specimen, probably referable to this species, was found amongst material from *Thylogale eugenii*, Kangaroo Island (W.1069).

Dipetalonema roemeri (Linstow).

Many specimens (W.370), forwarded by the late Dr. T. L. Bancroft from Eidsvold, Upper Burnett River, Queensland. The host is not mentioned, but Bancroft had previously recorded the presence of the species (as *Filaria websteri*) in the kangaroo *Macropus major*, and had sent us specimens from that host as well as from *M. parryi*, both from the vicinity of Eidsvold. The synonymy of *F. websteri* and *D. roemeri* has been discussed by us (J. & M., 1938*a*, 111).



Figs. 8-12.—*Zoniolaimus eugenii*, n. sp.: 8, anterior end; 9, anterior view of head; 10, lateral view of head; 11, bursa; 12, dorsal ray. b, buccal ring; p, excretory pore.

Dipetalonema sp.

From the liver of a wallaby (G.11103), labelled as "cysts of *Ascaris*". The worms are all females. They are 90–100 mm. long, and about 1·3 mm. maximum breadth, and are coiled up very tightly in pockets in the liver. All the specimens are immature and the vulva was not observed. The anterior end is rounded and bears four submedian and two larger (lateral?) papillae, the larger lying slightly behind the submedian. The posterior end of the oesophagus was not seen. The tail is short (0·17 mm.) and its tip is rounded.

As indicated earlier in this report, it is possible that the wallaby may have been *Wallabia bicolor* var. *mastersi* Krefft from the Burnett River, Queensland.

Physaloptera sp.

From *Thylogale eugenii*, near Kingscote, Kangaroo Island (W.1069). Specimen 7·4 mm. long; without sex organs. Anus 0·17 mm. from the tip of the bluntly pointed tail. The cervical collar does not cover the lips. Each lip bears a pair of large papillae and has apparently only a median tooth.

The specimen is a larval form whose adult stage is probably to be sought in an eagle or large hawk. Owing to distortion we have not been able to compare the worm with the various known species dealt with by Cram and by Ortlepp.

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SYDNEY UNIVERSITY PLANKTON INVESTIGATIONS,
under the Direction of Professor W. J. Dakin, D.Sc.

A SMALL COLLECTION OF CHAETOGNATHS FROM THE COAST OF NEW SOUTH WALES.

By

Takasi Tokioka.
(Seto Marine Biological Laboratory, Japan.)

(Figures 1–10.)

Through the kindness of Prof. E. A. Briggs, of the University of Sydney, I had a chance to examine a small collection of chaetognaths obtained by Prof. W. J. Dakin from the waters along the coast of New South Wales, eastern Australia, approximately between the latitudes of 33° and 35° S. and along the 151° E. long. This material includes 126 individuals referable to 10 species. The chaetognath-fauna of the coastal waters of eastern Australia was studied by Ritter-Záhony (1909) and Johnston and Taylor (1919), who recorded *Sagitta bipunctata*, *S. serratodentata*, *S. robusta*, *S. australis*, *S. enflata*, *S. pulchra*, *S. minima*, *S. regularis*, *S. tenuis*, *S. neglecta* and *Spadella moretonensis*. The present material adds 6 species to the above list, namely, *S. hexaptera*, *S. lyra*, *S. ai*, *S. planctonis*, *Pterosagitta draco* and *Krohnitta subtilis*.

In the following, I propose to describe the present material, giving the armature-formula to each species.

Sagitta hexaptera d'Orbigny.

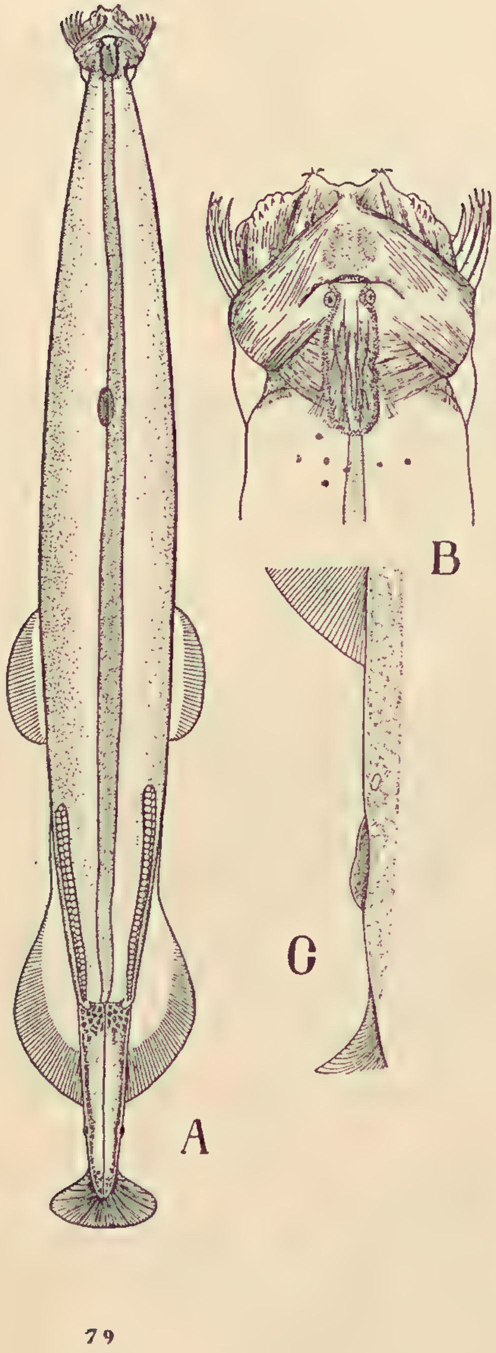
(Fig. 1.)

Sagitta hexaptera Aida, 1897; Fowler, 1906; Ritter-Záhony, 1909, 1911, *a*, *b*; Michael, 1919; Johnston and Taylor, 1921; Tokioka, 1939.

Sagitta tricuspidata Doncaster, 1903.

Sagitta fowleri Benham, 1912.

Twelve individuals, of which nine are from the offshore waters, while the other three were found in the inshore plankton sample which is labelled "All year, commonest species". This species seems, therefore, to be a common visitor to the coastal waters of New South Wales, though not very abundant in quantity. No difference is found between the armature-formulae of the Australian and Japanese specimens.



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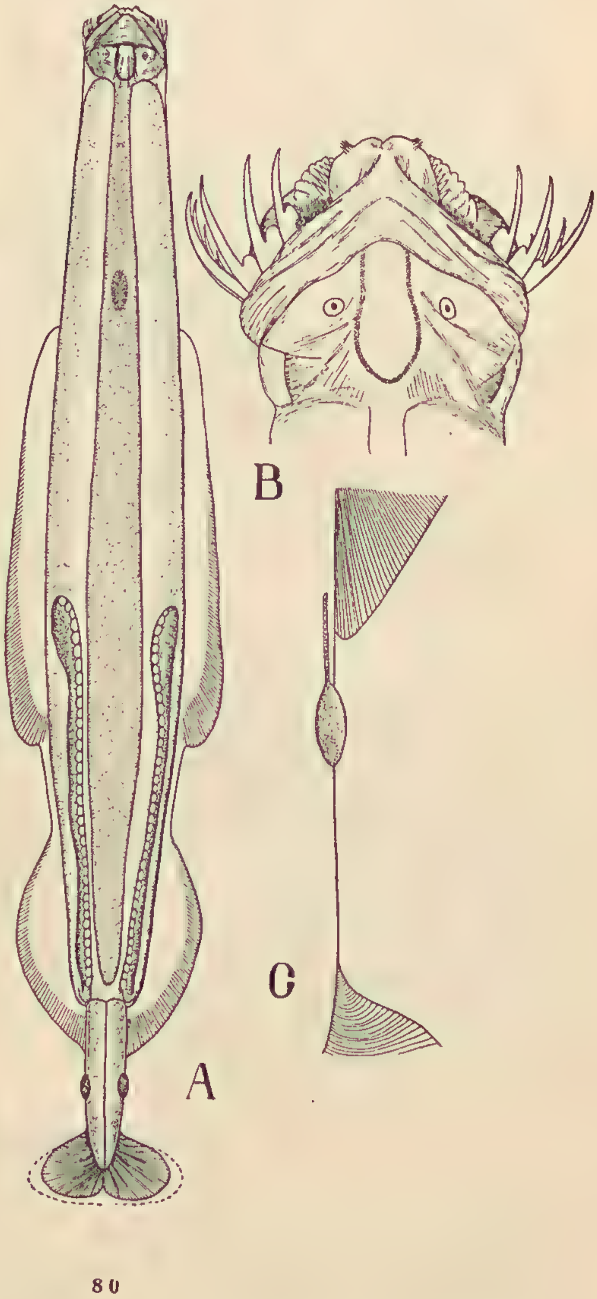

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Figures 1-2.

Fig. 1.—*Sagitta hexaptera* d'Orbigny. A, entire animal, dorsal; B, head, dorsal; C, seminal vesicle, dorsal.

Fig. 2.—*Sagitta lyra* Krohn. A, entire animal, dorsal; B, head, dorsal; C, seminal vesicle, dorsal.

Formula:

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
21·0–22·6	22·6–24·8	7–10	1–3	1–2
24·1–25·0	24·0–24·1	7–9	2–3	2–2
33·0–33·8	20·6–22·2	8–8	1–3	1–2
35·4–35·7	20·7–22·0	8–8	1–2	2–2
37·0–37·3	21·4–21·6	8–9	2–2	1–2
37·4–37·8	21·1–21·2	7–8	0–3	0–4

Sagitta lyra Krohn.

(Fig. 2.)

Sagitta lyra Aida, 1897; Johnston and Taylor, 1921; Tokioka, 1939.
Sagitta gazellae Ritter-Záhony, 1909.
Sagitta lyra + *Sagitta gazellae* Ritter-Záhony, 1911, *a*, *b*.
Sagitta furcata Steinhaus, 1896; Fowler, 1906.

Five individuals, of which two are from the offshore waters and three are found in the sample of *S. enflata* collected from the inshore waters. These five are all of the "*gazellae*"-type.

Formula:

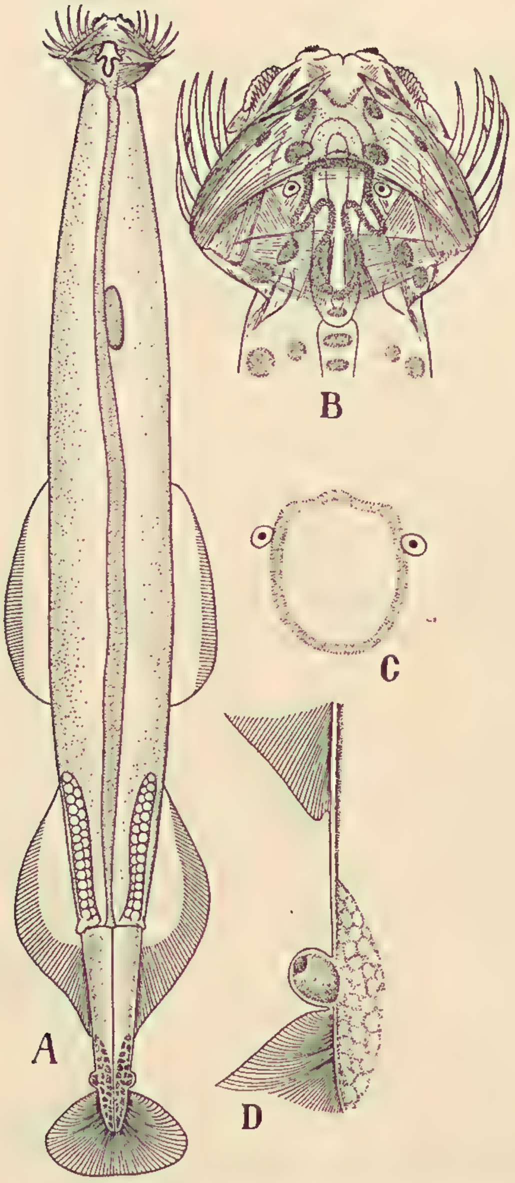
Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
25·1–26·9	15·5–15·6	6–7	3–?	7–?
27·0 (2)	18·5	8–9	4–6	10–10
36·1	13·9	9–9	6	8

Sagitta enflata Grassi.

(Fig. 3.)

Sagitta enflata Béraneck, 1895-6; Aida, 1897; Fowler, 1906; Ritter-Záhony, 1911, *a*, *b*; Michael, 1919; Tokioka, 1939.
Sagitta enflata + *Sagitta gardineri* + *Sagitta flaccida* Doncaster, 1903.
Sagitta australis Johnston, 1909.
Sagitta enflata f. *minor* Ritter-Záhony, 1909.
Sagitta enflata + *Sagitta australis* Johnston and Taylor, 1919.
Sagitta enflata + *Sagitta gardineri* John, 1933.
Sagitta gardineri Lele and Gae, 1936.

Twenty-four individuals collected from the inshore waters and labelled "All year, commonest species". This species is commonest in the warm oceanic waters of the world. The formula of the Australian specimens is exactly the same as that of the Japanese specimens.



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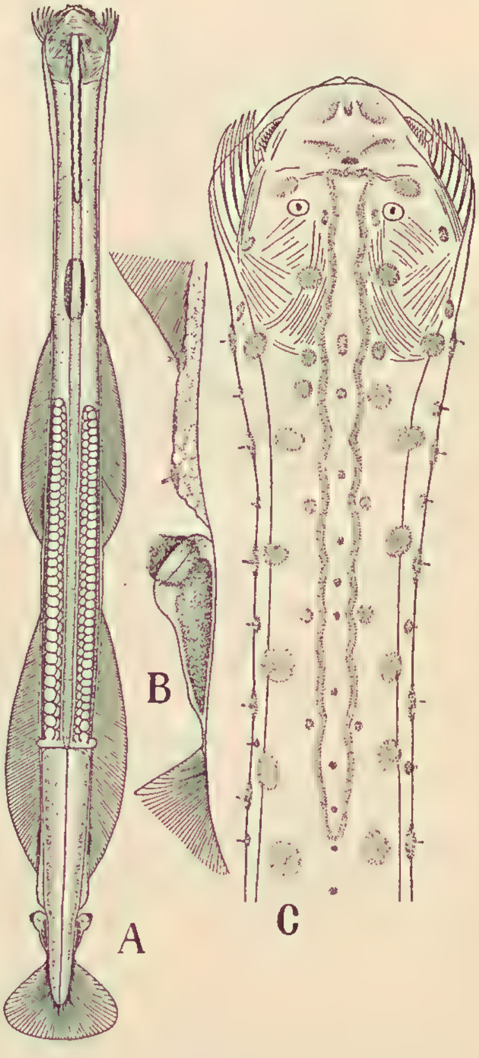

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Figures 3-4.

Fig. 3.—*Sagitta enflata* Grassi. A, entire animal, dorsal; B, head, dorsal; C, simple corona ciliata; D, seminal vesicle, ventral.

Fig. 4.—*Sagitta bipunctata* Quoy et Gaimard. A, entire, dorsal; B, seminal vesicle, dorsal; C, anterior part of trunk, dorsal.

Formula:

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
16·0–17·0	20·0–20·6	8–9	6–7	11–13
17·0–17·4	19·4–20·1	7–9	8–8	12–13
17·5–17·6	18·2–18·3	8–8	6–11	12–16
17·7–17·8	19·2–22·5	8–9	7–8	12–14
18·0–18·5	16·7–19·5	8–9	5–8	10–14

Remarks: Johnston claims that *S. australis* is different from *S. enflata* in the beginning point of the anterior fin and in the situation of the broadest portion of the posterior fin. The former character shows, however, a considerably wide range of variation in some species, like *S. lyra*, *S. setosa* and *S. levis*. In fact *S. gardineri* from the Indian Ocean shows the intermediate condition in this respect between *S. australis* and *S. enflata*. Regarding the latter character, the situation of the broadest portion of the posterior fin is at the tail septum in *S. enflata*, although it may be slightly in front of or slightly behind the tail septum in some individuals. This character is difficult to observe in mounted specimens, on which *S. australis* was established originally. It is to be noted that the posterior teeth of *S. australis* are fewer than those of the typical *S. enflata* tabulated above.

Sagitta bipunctata Quoy et Gaimard.

(Fig. 4.)

Sagitta bipunctata Ritter-Záhony, 1909, 1911, *a*, *b*; Johnston and Taylor, 1919; Tokioka, 1939.

Sixteen individuals. Common in the warm oceanic waters. The formulae of both the Australian and Japanese specimens conform exactly with each other.

Formula:

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
11·2–12·0	27·5–28·6	8–9	5–6	11–12
12·4–13·3	24·8–27·4	9–9	6–8	13–13
13·5–13·6	26·5–27·4	9–9	6–7	11–15
13·7–14·1	27·0–28·4	8–9	6–6	13–16
14·3–14·4	26·6–27·1	9–9	6–7	15–15
15·0	26·0	9–9	7	15

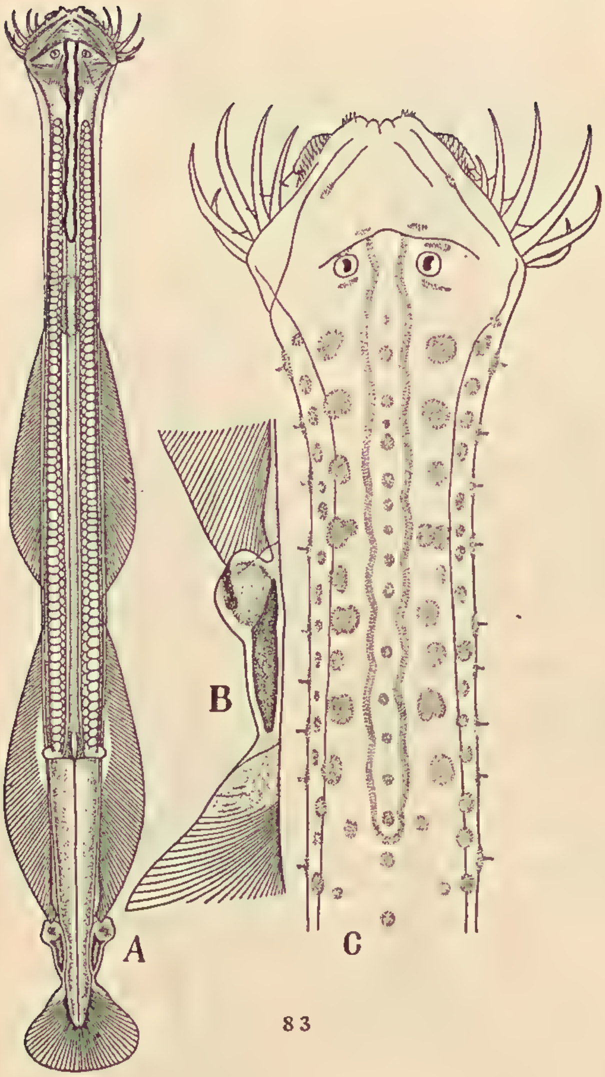
Sagitta robusta Doncaster.

(Fig. 5.)

Sagitta hispida, Aida, 1897.

Sagitta robusta + *Sagitta ferox* Doncaster, 1903.

Sagitta robusta Fowler, 1906; Ritter-Záhony, 1909, 1911, *a*, *b*; Johnston and Taylor, 1919; John, 1933; Tokioka, 1939.



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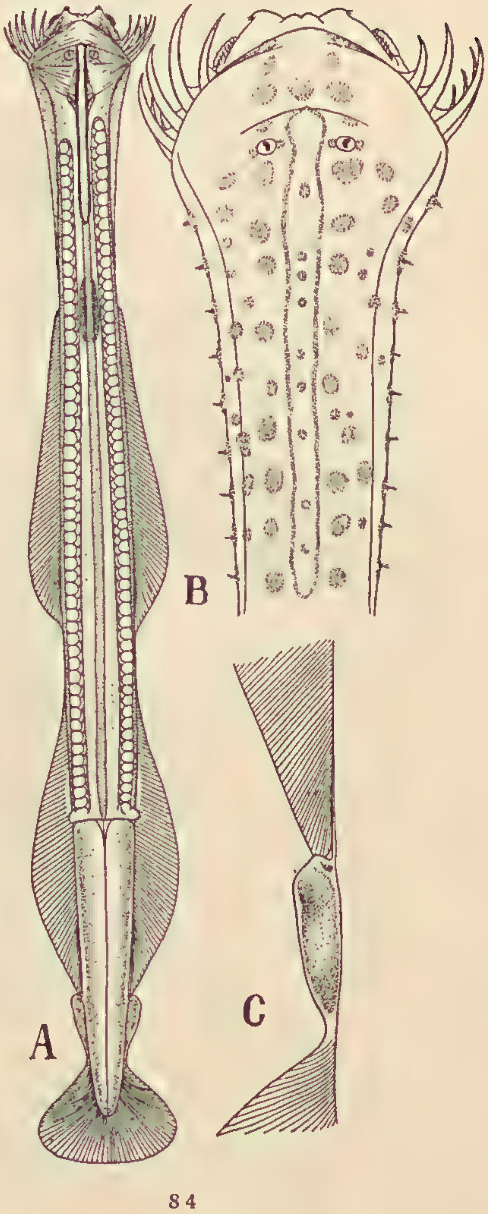

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Figures 5-6.

Fig. 5.—*Sagitta robusta* Doncaster. A, entire animal, dorsal; B, seminal vesicle, ventral; C, anterior part of trunk, dorsal.

Fig. 6.—*Sagitta ai* Tokioka. A, entire animal, dorsal; B, anterior part of trunk, dorsal; C, seminal vesicle, ventral.

Sixteen individuals. Common in the warm oceanic waters. The Australian specimens show exactly the same formula as the Japanese specimens.

Formula:

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
10·7–11·5	31·8–33·1	7–8	5–6	12–13
11·7 (2)	31·6–32·5	7–7	6–6	11–12
12·0 (2)	28·3–30·0	7–7	6–7	11–12
12·6–12·8	29·7–31·0	7–8	6–7	13–14
12·9–13·0	27·9–30·8	7–8	6–7	13–15

Sagitta ai Tokioka.

(Fig. 6.)

Sagitta ai Tokioka, 1939.

Twelve individuals. Common, but less so than the preceding species. This species resembles very closely *S. robusta*, but differs distinctly from the latter in (1) the body length of mature individuals, (2) the shape of the seminal vesicle, and in (3) the number of hooks, which is usually 5-6 in the former species, while it is 7-8 in the latter.

Formula:

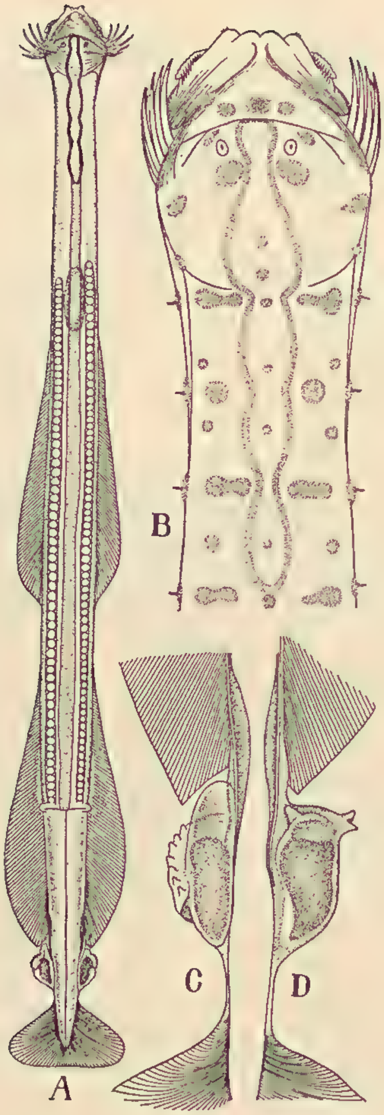
Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
9·5–10·5	30·5–31·6	6–7	6–7	10–11
10·5–11·5	29·5–30·4	6–7	6–6	11–12
13·0 (2)	26·2–30·0	6–7	6–9	13–14
13·6 (2)	28·6–28·7	5–7	7–9	10–13
13·8–15·5	28·4–30·4	6–6	7–7	12–12
15·5–19·0	30·3–31·1	5–6	7–8	11–13

Sagitta serratodentata Krohn.

(Fig. 7.)

Sagitta serratodentata Béraneck, 1895-6; Aida, 1897; Doncaster, 1903; Fowler, 1906; Ritter-Záhony, 1909, 1911, *a*, *b*; Michael, 1919; Johnston and Taylor, 1919, 1921; Tokioka, 1939.

Eight individuals, of which six have the same formula for the cephalic armature and the same appearance of the seminal vesicle (Fig. 7, *c*) with several chitinous teeth as in the Japanese specimens. The other two have the seminal vesicle (Fig. 7, D) differing from those of the preceding six individuals, in that it has two prominences at the antero-lateral corner as in the Atlantic or Mediterranean specimens, but has no chitinous teeth along the lateral side. The number



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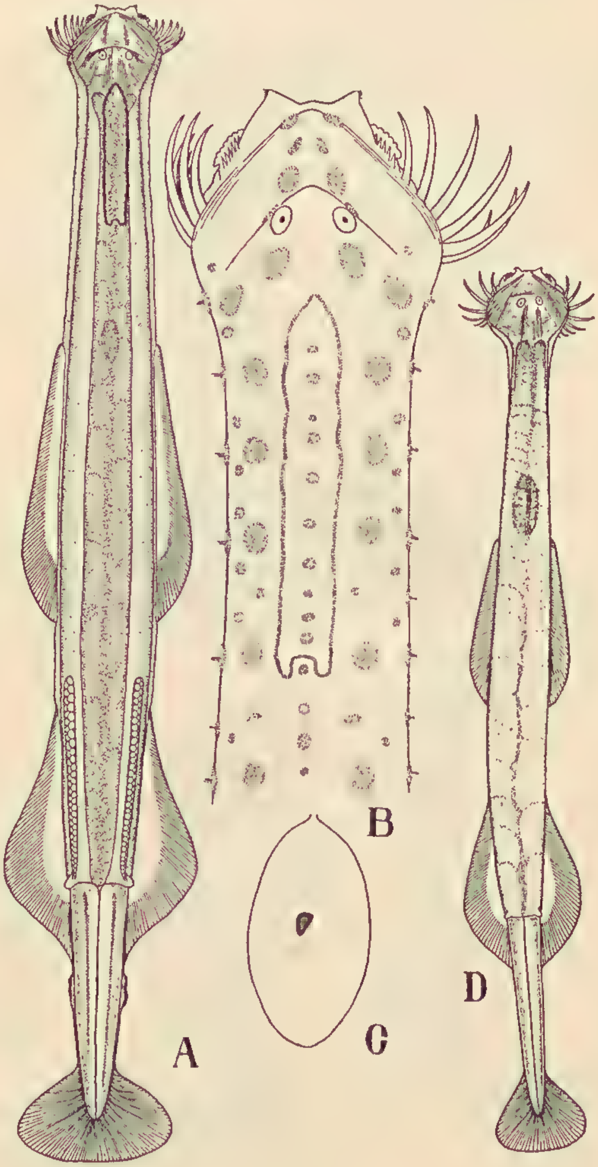

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Figures 7-8.

Fig. 7.—*Sagitta serratodentata* Krohn. A, entire animal, dorsal; B, anterior part of trunk, dorsal; C, seminal vesicle of Pacific form, ventral; D, seminal vesicle of Atlantic or Mediterranean form, dorsal.

Fig. 8.—*Sagitta planctonis* Steinhaus. A, entire animal, dorsal; B, anterior part of trunk, dorsal; C, eye; D, young (9 mm.) individual, dorsal.

of the posterior teeth in these two individuals is less than that of the common Pacific individuals (which may be called *forma pacifica*), having the seminal vesicle with the chitinous teeth. Whether any intermediate form exists between the Pacific and the Atlantic or Mediterranean forms in regard to this character, and how the Pacific and the Atlantic or Mediterranean forms are distributed in the waters of the world may be ascertained by a further study.

Formula (common Pacific forms):

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
10·9–11·5	24·3–24·8	6–6	7–9	17–18
12·0–12·3	24·2–26·8	6–?	9–?	20–?
13·0–13·8	26·2–26·8	6–6	8–10	18–24

Formula (Atlantic or Mediterranean forms):

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
11·3–12·2	25·4–26·5	6–7	6–7	13–14

Sagitta planctonis Steinhaus.

(Fig. 8.)

Sagitta planctonis, Steinhaus 1896; Ritter-Záhony, 1909, 1911, *a*, *b*; Michael, 1919; Johnston and Taylor, 1921; Tokioka, 1939.

Sagitta planctonis + *Sagitta zetesios* Fowler, 1906.

Twenty-five individuals. In the Japanese waters, this species is a rare meso-planktonic organism. The Australian specimens, 9-27·2 mm. in body length, are all immature. In none of the specimens does the ovary reach beyond the front end of the posterior fin, nor is there a seminal vesicle. The most striking point of the Australian specimens is the shape of the corona ciliata (Fig. 8, B), which differs from the figure given by Ritter-Záhony (1911, *a*). It begins on the neck and stretches posteriorly about two times the head length. The anterior end is pointed like an apex of a triangle; the posterior end is cut transversely and the middle portion of the posterior border is markedly depressed anteriorly, containing a small sensory spot in this depression. The eye is large, though the eye-pigment is very small. The intestine is usually swollen considerably and fills (in young individuals) the whole trunk coelom, showing a septate appearance as in *S. minima* (Fig. 8, D). The number of the anterior and posterior teeth of the Australian specimens is fewer than that of the Japanese specimens.

Formula (Australian specimens):

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
9·0	25·6	9–9	5	7
13·0–14·7	23·8–25·4	8–9	5–5	9–9
15·2–15·9	24·5–25·7	6–9	4–4	8–8
16·0 (2)	22·5–24·4	7–10	6–7	9–10
16·0 (2)	23·8–25·0	7–9	3–7	8–11
17·2–17·8	22·7–23·0	7–9	4–6	9–10
18·2–19·0	22·5–23·7	5–9	5–6	11–11
20·0–20·3	22·7–23·0	7–9	6–7	9–13
21·0–21·5	21·4–22·8	7–9	5–7	10–11
22·0–22·5	22·2–22·3	6–9	5–5	10–11
24·8–27·2	22·4–23·8	8–9	5–7	12–12

Formula (Japanese specimens):

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
17·5–18·5	25·7–25·9	8–9	9–10	16–18
20·0–21·4	25·5–28·0	9–10	10–10	17–19
24·0 (2)	25·4–27·1	9–9	10–11	17–19
25·5–26·0	23·9–28·8	7–8	8–12	14–19
26·1–27·0	24·9–25·9	7–8	8–10	14–16
27·5–31·1	25·5–26·0	8–8	5–10	7–19
34·8	23·9	7–8	11	16

The formulae given by Ritter-Záhony (1911, *a*, *b*) seem to be rather aberrant in the number of anterior and posterior teeth, which fact suggests a rather wide range of variation of this character.

Pterosagitta draco (Krohn).

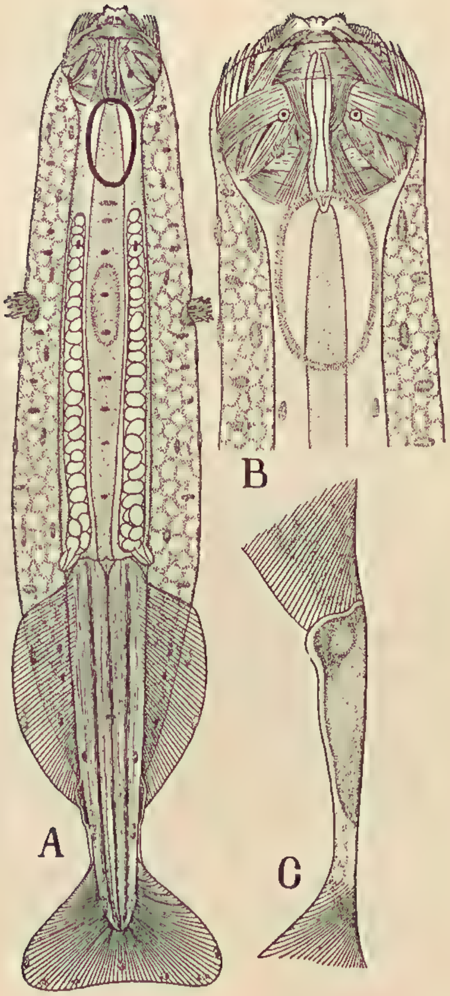
(Fig. 9.)

Spadella draco Aida, 1897; Doncaster, 1903; Fowler, 1906.

Spadella draco + *Spadella vougai* Béraneck, 1895-6.

Pterosagitta draco Ritter-Záhony, 1911, *a*, *b*; Johnston and Taylor, 1919; Michael, 1919; Tokioka, 1939.

Seven individuals. This species occurs frequently in the warm oceanic waters, though not large in quantity. The formula of the Australian specimens conforms quite with that of the Japanese specimens.



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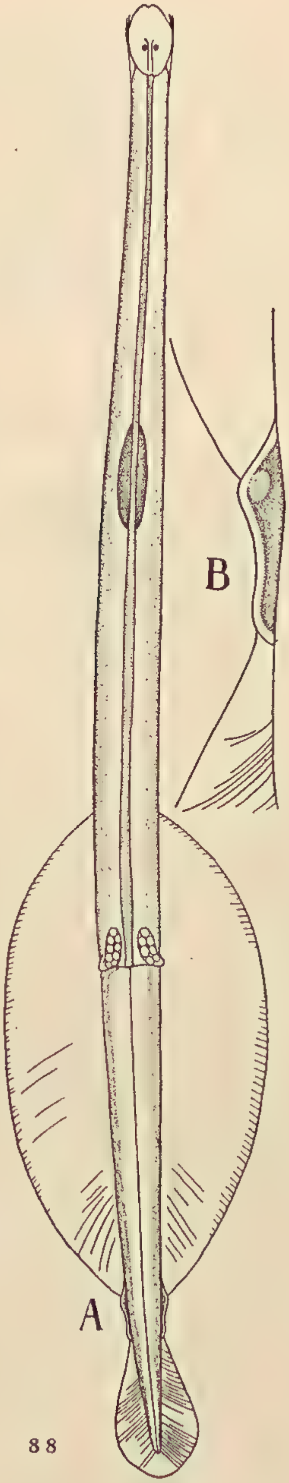

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Figures 9-10.

Fig. 9.—*Pterosagitta draco* (Krohn). A, entire animal, dorsal; B, anterior part of trunk, dorsal; C, seminal vesicle, dorsal.

Fig. 10.—*Krohnitta subtilis* (Grassi). A, entire animal, dorsal; B, seminal vesicle, dorsal.

Formula:

Body Length in mm.	Tail Segment in %.	Hooks.	Anterior Teeth.	Posterior Teeth.
7·9–8·5	41·2–45·6	9–10	7–8	12–15
8·9–9·0	43·8–44·4	9–10	7–8	11–15
9·6–10·1	41·7–43·6	10–10	7–8	14–14
10·2	46·1	9–10	9	18

Krohnitta subtilis (Grassi).

(Fig. 10.)

Krohnia subtilis Fowler, 1906.

Krohnitta subtilis Ritter-Záhony, 1911, *a*, *b*; Johnston and Taylor, 1919; Michael, 1919; Tokioka, 1939.

One individual. A rare mesoplanktonic species. The formula—13·6 mm., 36·0%, 7 (hooks), 12 (teeth)—is in the range of the formula of the Japanese specimens.

Concluding Remarks.

All the species contained in the present collection are the inhabitants of the warm oceanic waters and are fished chiefly from the surface layer, except the mesoplanktonic *Sagitta planctonis* and *Krohnitta subtilis*. Each of the ten species shows exactly the same appearance of the body and the same formula of the cephalic armature as the specimens from the Japanese waters, except for the samples of *S. planctonis*, which are provided with fewer teeth as compared with the Japanese specimens. In the Japanese waters, the species commonest and largest in quantity are *S. enflata* and *S. bedoti*. *S. robusta*, *S. ai*, *S. bipunctata*, *S. serratodentata* and *P. draco* are next in abundance. *S. hexaptera* and *S. lyra* are also common, but not abundant, while *S. planctonis* and *K. subtilis* belong to the rare group. The present Australian material is of note in the following respects: (1) no individual of *S. bedoti*, which is one of the commonest species in the north Pacific, is included, (2) many individuals of mesoplanktonic *S. planctonis* obtained from the inshore waters are included; this species is very rare in the Japanese waters, and (3) two individuals of *S. serratodentata* which have the seminal vesicle like that of the Atlantic or Mediterranean specimens are found mingled with the individuals provided with the vesicle of the type found commonly in the Pacific forms.

Taking the collection as a whole the most common form in the inshore plankton off this portion of the New South Wales coast is *S. enflata*, which occurs throughout the whole year.

S. bipunctata, *S. robusta*, *S. ai*, *S. serratodentata*, and *P. draco* occur fairly commonly in the inshore waters in the autumn months (April and May). *S. planctonis* occurs only occasionally in these waters during the summer months—it has appeared more commonly in certain catches taken in more southern waters.

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